SOIL SURVEY OF

Wyoming County, New York

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Cornell University
Agricultural Experiment Station

Issued April 1974

Major fieldwork for this soil survey was done in the period 1963–68. Soil names and descriptions were approved in 1969. Unless otherwise indicated statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Cornell University Agricultural Experiment Station with financial aid from Wyoming County Board of Supervisors. It is part of the technical assistance furnished to the Wyoming County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Wyoming County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings and recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties significant to engineering, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in Wyoming County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County."

Cover: **Typical landscape in association 13. The steeper soils in the background are in association 9.**

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SOIL SURVEY OF WYOMING COUNTY, NEW YORK

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UNITED STATES DEPARTMENT OF AGRICULTURE, IN COOPERATION WITH CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

WYOMING COUNTY, in the western part of New York State (fig. 1), is about 20 miles east of Lake Erie, 35 miles south of Lake Ontario, and about 35 miles north of the Pennsylvania State line. It has an area of about 382,720 acres or about 598 square miles.

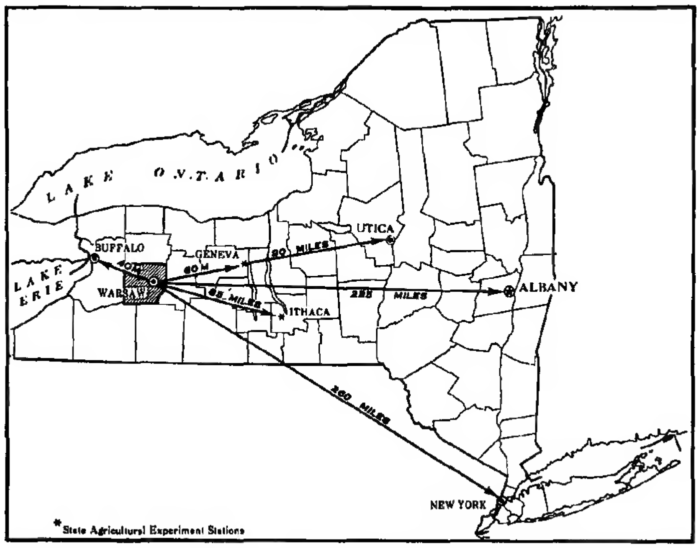

Figure 1.—**Location of Wyoming County in New York.**

Most of the county is in farms, and about two-thirds of this acreage is in crops. Dairying is the dominant type of farming. Important crops, in addition to those grown for dairying, are white potatoes, dry beans, wheat, and maple products.

About one-third of the county is wooded. Most of the wooded areas are scattered throughout, mostly on the steeper soils.

Letchworth State Park is in the southeastern part of the county. The New York State Department of Environmental Conservation manages the Carlton Hill Multiple Use Area in the north-central part of the county.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Wyoming County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Chenango and Lordstown, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Erie silt loam, 0 to 3 percent slopes, is one of several phases within the Erie series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this survey was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is exactly equivalent, because it is not practical to show on such a map all

the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Wyoming County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Howard-Madrid gravelly loams, 8 to 15 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Howard and Chenango soils, 25 to 40 percent slopes, is an undifferentiated soil group in this county.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Alluvial land is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structure, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to a high water table. They see that streets, road pavements, and foundation for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Wyoming County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The soil associations in this survey have been grouped into four general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in each group are described in the following pages.

Soils Formed in Glacial Till

These associations are mainly on higher uplands in Wyoming County. They occupy about 63 percent of the county. The soils formed in deep to shallow deposits of unassorted glacial till derived mainly from shale, siltstone, sandstone, and, to a lesser degree, limestone. These soils are nearly level to very steep, have very low lime to medium lime profiles, and have a medium-textured to fine-textured subsoil. The more extensive soils are mainly somewhat poorly drained and moderately well drained, but they range from excessively drained to poorly drained. Dairying is the major farm enterprise. A large acreage is idle, and a considerable acreage is wooded.

1. Conesus-Lansing association

Deep, moderately well drained and well drained, medium-lime soils that have a medium-textured subsoil; on uplands

This association (fig. 2) is on the rolling plain and drumlin-like uplands in the northeastern part of the county. It is part of a broad band of medium-lime, medium-textured soils. These soils formed in glacial till that extends eastward from Wyoming County and southeastern Genesee County, across the foot slopes of the Allegheny Plateau to central New York State. Areas of this association are in most of the town of Covington and about half of the town of Perry. Smaller areas are in the towns of Castile, Middlebury, and Attica.

This association makes up about 10 percent of the county. Conesus soils make up about 35 percent of the association; Lansing soils, about 25 percent; and minor soils, the remaining 40 percent.

The deep, moderately well drained Conesus soils are nearly level to moderately sloping. These soils are in broad, undulating to rolling areas. They have a seasonal high water table at a depth of $1\frac{1}{2}$ to 2 feet that persists for short periods in spring and after wet periods.

The deep, well-drained Lansing soils are gently sloping to steep. They are intermingled with Conesus soils in

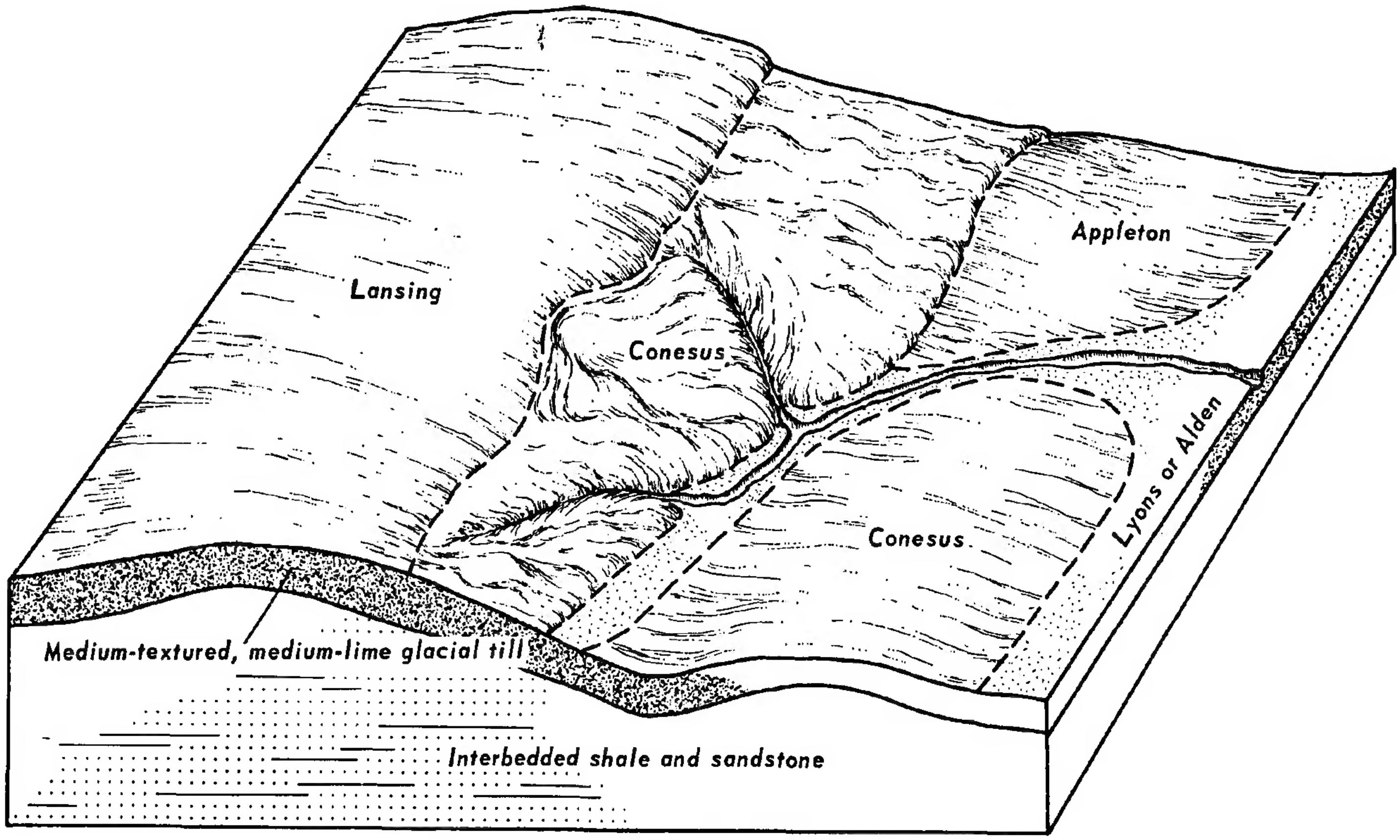

Figure 2.—Typical pattern of soils in association 1.

drumlin-like convex areas. They are similar to Conesus soils.

Among the more extensive minor soils are the somewhat poorly drained Appleton soils that formed in similar material. These soils are on foot slopes and in concave areas where runoff is slow or where water accumulates. Poorly drained and very poorly drained Lyons and Alden soils are in depressions. Other minor soils are the Burdett, Danley, and Nunda soils, a few areas of Arkport soils on deltas, and a mixture of soils that formed in alluvium along the small streams and drainageways that cross this association.

This association is one of the more suitable areas in the western part of New York for growing dry beans, field corn, and winter grain. The response of crops to high levels of management is good. Most farms need some artificial drainage.

The better drained soils provide good homesites, but in about half the soils in this association wetness is at least a moderate limitation, or the development of sewage disposal systems is a moderate problem.

2. *Nunda-Danley association*

Deep, moderately well drained, medium-lime soils that have a moderately fine textured subsoil; on uplands

This association is in several small areas on uplands near the upper fringe of the Allegheny Plateau, from just south of the village of Attica to the plateau fringes alongside the village of Perry. The soils in this association are gently sloping to moderately steep. They generally are on long slopes where little water accumulates.

This association makes up about 1.9 percent of the county. Nunda soils make up about 35 percent of the association; Danley soils, about 30 percent; and minor soils, the remaining 35 percent.

The deep, moderately well drained Nunda soils have a loamy or silty mantle underlain by a heavier textured, shaly subsoil and glacial till.

The moderately well drained Danley soils have a shaly subsoil and substratum similar to the Nunda soils, but they lack the loamy or silty mantle.

The more extensive minor soils are the somewhat poorly drained Burdett and Darien soils that formed in similar material. These soils are on foot slopes and in areas where more water accumulates. Other minor soils are the moderately well drained Aurora soil that is moderately deep over shale, the coarser textured, moderately well drained Conesus soil, and the wetter Lyons and Ilion soils in depressional areas.

The soils of this association are used for crops that are used in dairy operations. Response of these soils to good management techniques, including erosion control, is good.

The Nunda and Danley soils slope enough for water to run off quickly and cause erosion to be a hazard. Runoff, the hazard of erosion, and a slowly permeable subsoil affect the use of these soils for community development.

3. Darien-Ilion association

Deep, somewhat poorly drained and poorly drained, medium-lime soils that have a moderately fine textured subsoil; on uplands

This association is on parts of the shaly glacial till that occupies the ascending landscape of the Allegheny Plateau, as ascended going in a southerly direction. The soils in this association are nearly level to gently sloping. These medium-lime soils have a moderately fine textured subsoil. They formed in shaly glacial till. The largest area of this association is in a band between areas of strongly acid, shaly glacial till to the north and at a somewhat lower elevation and areas of shallow to sandstone bedrock that cap the Plateau across the north-central part of the county. A smaller area is on the central plain in the extreme northeastern part of the county.

This association makes up about 2.1 percent of the county. The Darien soils make up about 55 percent of the association; the Ilion soils, about 18 percent; and minor soils, the remaining 27 percent.

The deep, somewhat poorly drained Darien soils are nearly level to moderately sloping. The deep, poorly drained Ilion soils are in depressional areas.

Minor soils are the somewhat poorly drained Angola, Burdett, and Erie soils that are similar to the Darien soils. They occupy a position on the landscape similar to the Darien soils, but they differ from Darien soils in that Burdett soils have a loamy mantle, Erie soils have a fragipan, and Angola soils have shale bedrock at a depth of 1½ to 3½ feet.

Restricted internal drainage is the main limitation to use of the soils of this unit. The slow permeability in the subsoil and seasonal wetness limit these soils mainly to the growing of adapted forage crops used in dairying. These soil features also severely limit residential development.

4. Erie-Langford association

Deep, somewhat poorly drained, moderately well drained and well drained, low-lime soils that have a medium-textured subsoil; on uplands

This association is on the higher positions of the plateaus in the western part of the county. Slopes generally are long and smooth. The major soils in this association formed in deep, firm basal till derived mainly from sandstone and shale. Their content of lime is low. They have a strongly expressed fragipan that restricts rooting and water and air movement. Large areas of the major soils have bedrock at a depth of 4 to 6 feet.

This association makes up about 16.6 percent of the county. Erie soils make up about 45 percent of the association; Langford soils, about 30 percent; and minor soils, the remaining 25 percent.

The somewhat poorly drained Erie soils generally are nearly level to gently sloping. They have a fragipan at a depth of 10 to 16 inches. These soils are in areas where runoff is slow or water accumulates. A small part of the Erie soils is moderately sloping, generally on foot slopes below Langford soils.

The moderately well drained to well drained Langford soils generally are nearly level to gently sloping, but are steeper in places. They are slightly convex and accumulate little runoff in some areas, or they are moderately sloping to moderately steep and on side slopes below the plateau summit in others. These soils have a fragipan at a depth of 15 to 24 inches.

The more extensive minor soils are the poorly drained, nearly level Ellery soils that are in areas that receive considerable amounts of runoff from adjacent areas; and the very poorly drained Alden soils in depressional sags that remain wet most of the year unless drained. Other minor soils are the well-drained to somewhat excessively drained Howard soils, the well-drained Madrid soils, the somewhat poorly drained Fremont and Churchville soils, some soils that formed in alluvium along the headwaters of drainageways, and a few areas of rock outcrop along gorges notched into the uplands. Between the hamlets of Curriers and Arcade there are a few areas of moderately deep Lordstown soils on side slopes. Also included are the similar very low lime Volusia and Mardin soils that are near the fringe area between the Erie-Langford association and the Volusia-Mardin association. The Erie and Langford soils differ from the Volusia and Mardin soils only in being less acid in the lower part of the subsoil and the substratum.

Large areas of this association are cleared and used for dairy farming. Adapted legume species such as birdsfoot trefoil are very well suited to the soils. Most farms need artificial drainage if corn silage is grown. In undrained areas the low spots of Ellery soils and the drainageways and seep spots within the association interfere with row crops.

A few areas of this association are suitable for homesites, but most areas need drainage. Adequate sewage effluent disposal fields require careful design. This association is in the path of the Great Lakes snow belt. Snow squalls off Lake Erie are common, and drifting snow commonly makes roads impassable.

5. Bath-Mardin association

Deep, well drained and moderately well drained, very low lime soils that have a medium-textured subsoil; on uplands

This association (fig. 3) is on undulating to rolling hilltops in the north-central and east-central sections of the county. The northern fringes of the association have drumlin-like landforms similar to those of the Conesus-Lansing association. The major soils of this association have a very low content of lime. They formed in deep glacial till derived mainly from sandstone and shale. Many flat fragments of sandstone are throughout the profile. They have a fragipan that restricts rooting and air and water movement. The largest areas of this association are in the towns of Attica, Castile, Gainesville, Perry, and Warsaw.

This association makes up about 9.5 percent of the county. Bath soils make up about 35 percent of the association; Mardin soils, about 25 percent; and minor soils, the remaining 40 percent.

The well-drained Bath soils are nearly level to steep and have convex slopes where water does not accumulate. They have a fragipan at a depth of 18 to 34 inches.

The moderately well drained Mardin soils are intermingled with Bath soils. They are nearly level to moderately steep and have slopes where runoff is not rapid or where small amounts of water accumulate. They have a fragipan at a depth of 14 to 25 inches.

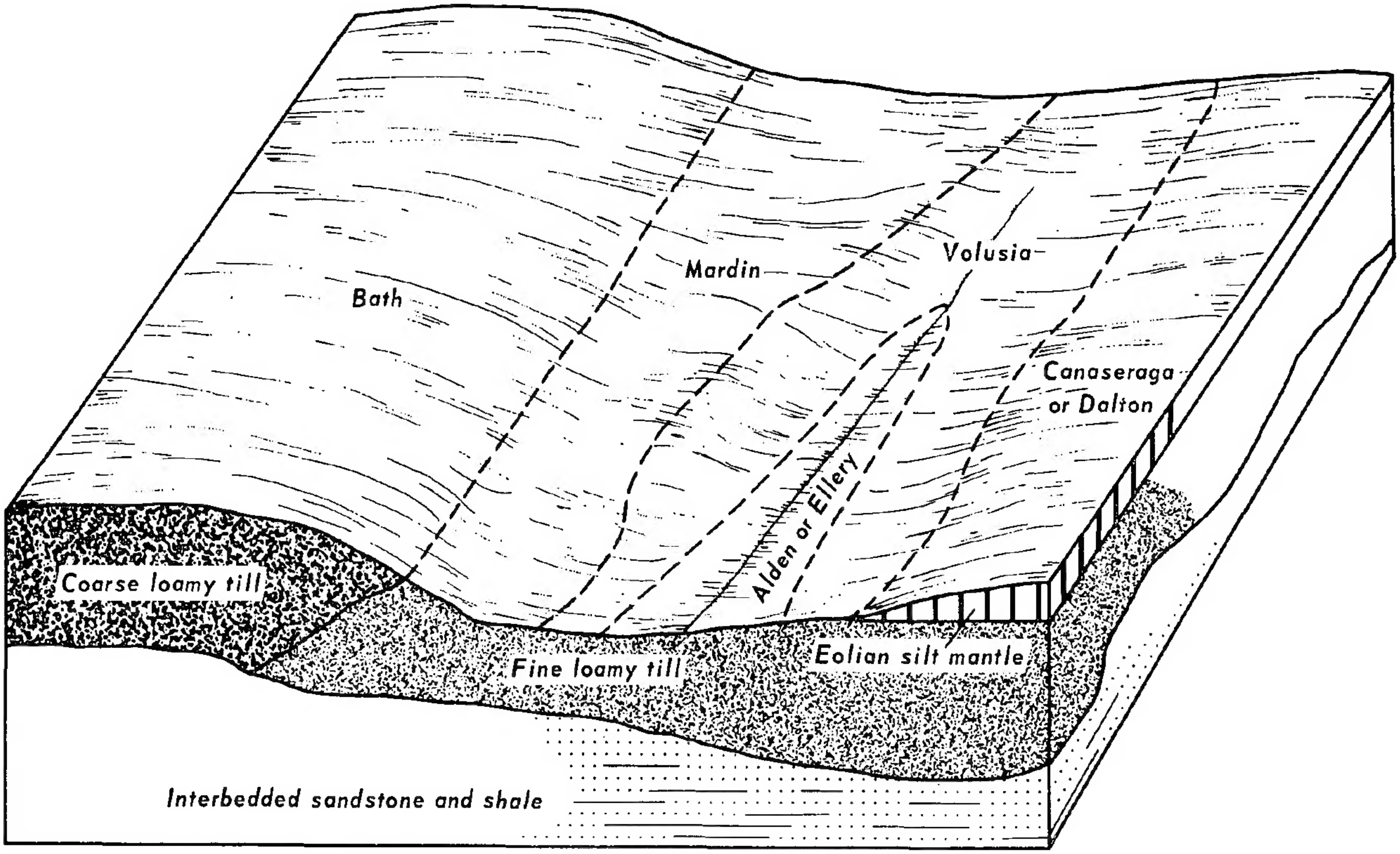

Figure 3.—**Typical pattern of soils in association 5.**

The more extensive minor soils are the somewhat poorly drained Volusia soils that are on foot slopes and in areas where runoff is slow or water accumulates, and the poorly drained Ellery soils; also, the very poorly drained Alden soils that are in concave areas and depressions where large amounts of water accumulate. Other minor soils are Canaseraga, Erie, Langford, Lordstown, and Valois soils, and various mixtures of soils that formed in alluvium along the narrow stream valleys that cross the association.

Most areas of this association are cleared and used for cash crops and dairy farming. Some potatoes are grown. The response of crops to high levels of management is good. Most farms require some artificial drainage. Lime needs are high if legume crops are grown.

The better drained soils provide good homesites, but in about half the areas of soils in this association, wetness is at least a moderate limitation, and sewage disposal systems require careful design.

6. Volusia-Mardin association

Deep, somewhat poorly drained and moderately well drained, very low lime soils that have a medium-textured subsoil; on uplands

This association is in areas on some of the higher elevations in the central part of Wyoming County. Most of the soils in this association are undulating and include fairly wide saddles of nearly level soils that generally are wet. These deep, very low-lime soils formed in deep glacial till derived mainly from sandstone and shale. Many flat fragments of sandstone are throughout the profiles.

The soils in this association make up about 8.5 percent of the county. Volusia soils make up about 40 percent of the association; Mardin soils, about 30 percent; and minor soils, the remaining 30 percent.

The somewhat poorly drained Volusia soils are mainly nearly level to gently sloping and are in areas where runoff is slow or water accumulates. A few areas of soils are moderately sloping and on foot slopes. These soils have a very dense fragipan at a depth of 10 to 18 inches that severely restricts rooting and water and air movement. They have numerous seep spots.

The moderately well drained Mardin soils have a strongly expressed fragipan at a depth of 14 to 25 inches. These soils are nearly level to moderately steep and are in areas where runoff is more rapid or where less water accumulates than in Volusia soils.

The more extensive minor soils are the poorly drained Ellery soils and the very poorly drained Alden soils. Other minor soils are the Bath, Canaseraga, Dalton, Erie, and Langford soils.

Many areas of this association were originally cleared and used for general farming, but an increasing acreage of this association is currently being used for recreational purposes or is being left idle. Large areas have been reforested. Lime and fertilizer requirements are very high. Most farms need drainage.

A few areas in this association are suitable for homesites, but most such areas need drainage. Adequate sewage disposal fields require careful design. Winters are excessively severe, especially in open areas. Blowing and drifting snow generally make the roads impassable.

7. *Fremont-Marilla-Hornell association*

Deep and moderately deep, somewhat poorly drained and moderately well drained, very low lime soils that have a medium-textured to fine-textured shaly subsoil; on uplands

This association (fig. 4) consists of areas of nearly level to moderately sloping soils on broad hilltops, steep soils on slopes, and soils in dissections. These very low lime soils formed in glacial till derived mainly from shale. The largest area in the association is a band about 2 miles wide that extends from west of the village of Attica to the extreme northwestern corner of the county. Of the two smaller areas, one is east of the village of Attica and adjacent to the Genesee County line, and the other just south of Cayuga Creek and adjacent to the Erie County line.

This association makes up about 3.8 percent of the county. Fremont soils make up about 35 percent of the association; Marilla soils, about 20 percent; Hornell soils, about 20 percent; and minor soils, the remaining 25 percent.

The deep, somewhat poorly drained Fremont soils have a medium-textured to moderately fine textured subsoil that restricts water and air movement. These soils are nearly level to moderately sloping and mainly are on broad hilltops where runoff is slow or where water accumulates. Smaller areas of steep soils are on side slopes and in dissections.

The deep, moderately well drained Marilla soils have a medium-textured shaly fragipan that restricts rooting and air and water movement. These soils are gently sloping to moderately sloping, and the slopes are convex. They are on hilltops where little water accumulates.

The somewhat poorly drained to moderately well drained Hornell soils have shale bedrock at a depth of 20 to 40 inches. These soils have a fine-textured subsoil that severely restricts rooting and air and water movement. They are mainly gently sloping and are on hilltops where water accumlates or where runoff is slow. Smaller areas of steep soils are on side slopes and in dissections. Some areas are on shelflike positions on north-sloping faces of the plateau.

Minor soils are mainly the shaly Ilion and Manlius soils. Poorly drained Ilion soils are in depressional areas. Manlius soils are well drained to excessively drained and have shale bedrock at a depth of 20 to 40 inches. They generally are on steeper side slopes. Also in this association are mixtures of soils that formed in alluvium and shaly Howard soils in the narrow valleys that dissect the association.

Some areas of this association are used for dairy farming, but an increasing acreage is being left idle. Lime and fertilizer requirements are very high if adequate crop growth is to be attained. Impeded internal drainage of the major soils of this association is commonly difficult to correct, and it limits use for farming.

Some scattered areas of shaly outwash are suitable for homesites, but the seasonal wetness and slow permeability

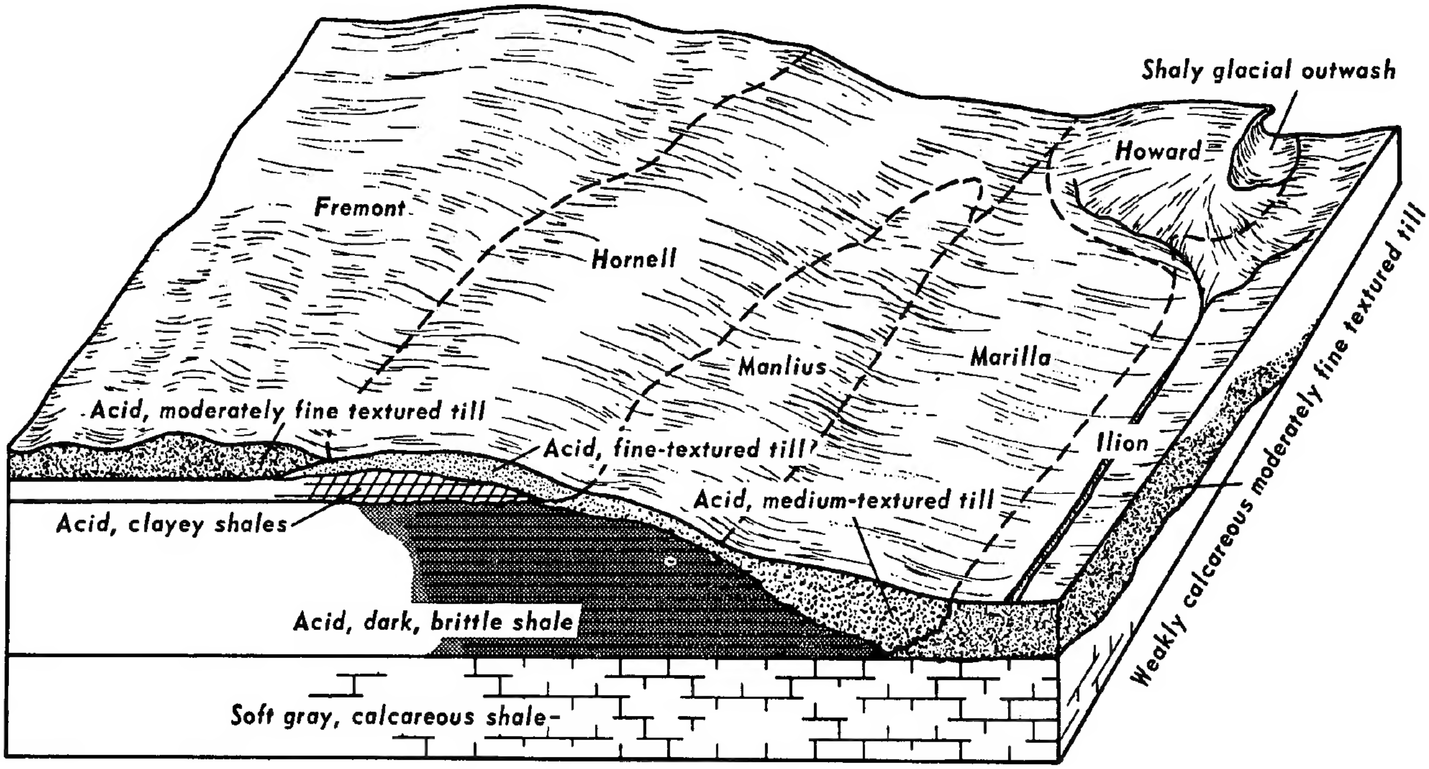

Figure 4.—Typical pattern of soils in association 7.

of most of the soils are limitations to this use. In the past few years, people from urban population centers have built summer homes and are constructing ponds and making tree plantations in these areas. This trend will probably continue, because the soils are not well suited to farming.

8. *Fremont-Mardin association*

Deep, somewhat poorly drained and moderately well drained, very low lime soils that have a moderately fine textured and medium-textured subsoil; on uplands

This association extends across the summits of hills and is on steeper side slopes. The soils are nearly level to moderately steep. These very low lime soils formed in deep glacial till in areas where the underlying bedrock is interbedded shale and sandstone. The largest areas of this association are in the towns of Pike and Eagle. A small area is on the crests of hilltops in the town of Middlebury.

This association makes up about 4 percent of the county. Fremont soils make up about 45 percent of the association; Mardin soils, about 35 percent; and minor soils, the remaining 20 percent.

The somewhat poorly drained Fremont soils have a medium-textured to moderately fine textured subsoil. They formed in till derived mainly from shale. These soils are nearly level to gently sloping and commonly are on the smooth hilltops, where runoff is slow or water accumulates.

The moderately well drained Mardin soils have a strongly expressed, medium-textured fragipan. They formed in till derived from a mixture of sandstone and shale. These soils are nearly level to moderately steep and are on convex hilltops or steeper side slopes, where runoff is more rapid and little water accumulates.

Minor soils are the poorly drained Ilion and Ellery soils in depressional areas, the somewhat poorly drained Volusia and Dalton soils that occupy a position on the landscape similar to those occupied by Fremont soils, and the moderately well drained Langford soils that are similar to Mardin soils and occupy a position on the landscape similar to that of the Mardin soils.

Some areas of this association are used for general farming. The operation of large farm machinery is facilitated by the large individual adjacent areas of soils that have slopes suitable for farming. The soils in this association generally are slow to dry in spring, but they dry evenly and do not have many seep or wet spots. Some areas of this association are game reserves.

Winters are commonly severe in the county, and blowing and drifting snow generally make the roads impassable in the areas of this association on exposed hilltops. In addition, seasonal wetness and slow permeability in the subsoil of the soils in this association are major considerations for community development.

9. *Manlius-Lordstown association*

Moderately deep, well-drained to excessively drained very low lime soils that have a medium-textured subsoil; on uplands

This association is in hillside areas adjacent to larger, deeper valleys that are dominantly across the northern half of the county. The soils in this association are steep or very steep.

This association makes up about 4.1 percent of Wyoming County. Manlius and Lordstown soils make up about 34 percent of the association, and minor soils make up the remaining 66 percent.

The well-drained to excessively drained, moderately deep Manlius soils are dominant in this association. These soils formed in till derived mainly from underlying shale bedrock, which is at a depth of 20 to 40 inches. They are steep and very steep.

The well-drained, moderately deep Lordstown soils are restricted to the higher elevations. These soils formed in till derived mainly from the underlying sandstone bedrock which is at a depth of 20 to 40 inches. They are also steep and very steep.

Among the more extensive minor soils are the steep, well-drained, deep Bath and Lansing soils; the steep and moderately steep, moderately well drained to well drained Langford soils; and the moderately well drained Danley and Nunda soils. Also, extremely steep gorge areas of rock outcrop and a mixture of very minor gently sloping soils generally are near the edges of this association.

Most areas of this association are wooded. Cleared areas are idle or used for general farming.

The dominant soils of this association generally are too steep for uses other than for woodland, wildlife habitat, or recreational purposes. Some of the more scenic parts of Letchworth State Park (fig. 5) are in this association.

10. *Lordstown-Tuller-Arnot association*

Moderately deep and shallow, well-drained to poorly drained, very low lime soils that have a medium-textured subsoil; on uplands

This association occupies the highest parts of the Allegheny Plateau and extends across the north-central part of the county. The soils in this association generally have a relatively thin soil mantle covering hard sandstone bedrock. They are nearly level to steep, and bedrock-controlled areas are characteristic (fig. 6)

This association makes up about 2.5 percent of the county. Lordstown soils make up about 25 percent of this association; Tuller soils, about 25 percent; Arnot soils, about 13 percent; and minor soils, the remaining 37 percent.

The moderately deep, well-drained Lordstown soils are gently sloping to steep. The shallow, somewhat poorly drained and poorly drained Tuller soils are nearly level to gently sloping. The well-drained and moderately well drained, shallow Arnot soils commonly occur in conjunction with some bedrock outcrop escarpments. Minor soils are the deeper Bath, Fremont, Mardin, and Volusia soils.

Some areas of this association, generally those that are not dominated by the shallow Arnot or Tuller soils, are used for general farming. These deeper areas are not so droughty and are less difficult to cultivate. A few rock quarries are in this soil association.

The shallowness to hard bedrock is the most important feature to consider for most nonfarm uses of most of the soils in this association.

Soils Formed in Glacial Outwash or Kame Deposits and Old Alluvial Fan Deposits

The soil associations in this group are mainly in the valleys, but some areas are on rolling side slopes scattered

Figure 5.—Genesee River gorge in Letchworth State Park.

throughout the county. This association makes up about 16 percent of the county. The soils are deep, and the more extensive ones formed in water-sorted glacial outwash derived mainly from sandstone and shale and varying amounts of limestone or in shaly old alluvial fans. Soils of lesser extent formed in recent alluvium or organic deposits. The soils have very low lime to high lime profiles. Most of the mineral soils have a medium-textured surface layer, but the texture of the subsoil is variable and ranges from very gravelly moderately coarse textured to moderately fine textured. Drainage ranges from somewhat excessive to very poor.

Some of the better drained soils are used for potatoes and cash-grain crops. Dairy farming is also important. The gravelly outwash soils provide some of the better sources of sand and gravel in the county. Some of the wetter areas provide wetland wildlife habitat.

11. Chenango-Howard-Castile association

Deep, somewhat excessively drained to moderately well drained, very low lime to medium-lime soils that have a medium-textured to moderately coarse textured very gravelly and gravelly subsoil; on outwash terraces and fans

This association (fig. 7) is in areas of glacial outwash and stream terraces and fans. The areas are scattered throughout valleys of the entire county. The soils in this association are level or gently sloping. These soils formed in valley trains and fans of gravelly and sandy glacial outwash.

This association makes up about 7.8 percent of the county. Chenango soils make up about 21 percent of this association; Howard soils, about 15 percent; Castile soils, about 14 percent; and minor soils, the remaining 50 percent.

The well-drained to somewhat excessively drained, very low lime Chenango soils formed in outwash derived mainly from sandstone and shale.

The well-drained to somewhat excessively drained, medium-lime Howard soils formed in outwash that contains sufficient limestone, sandstone, and shale to provide a less acid reaction and a more fertile subsoil than Chenango and Castile soils.

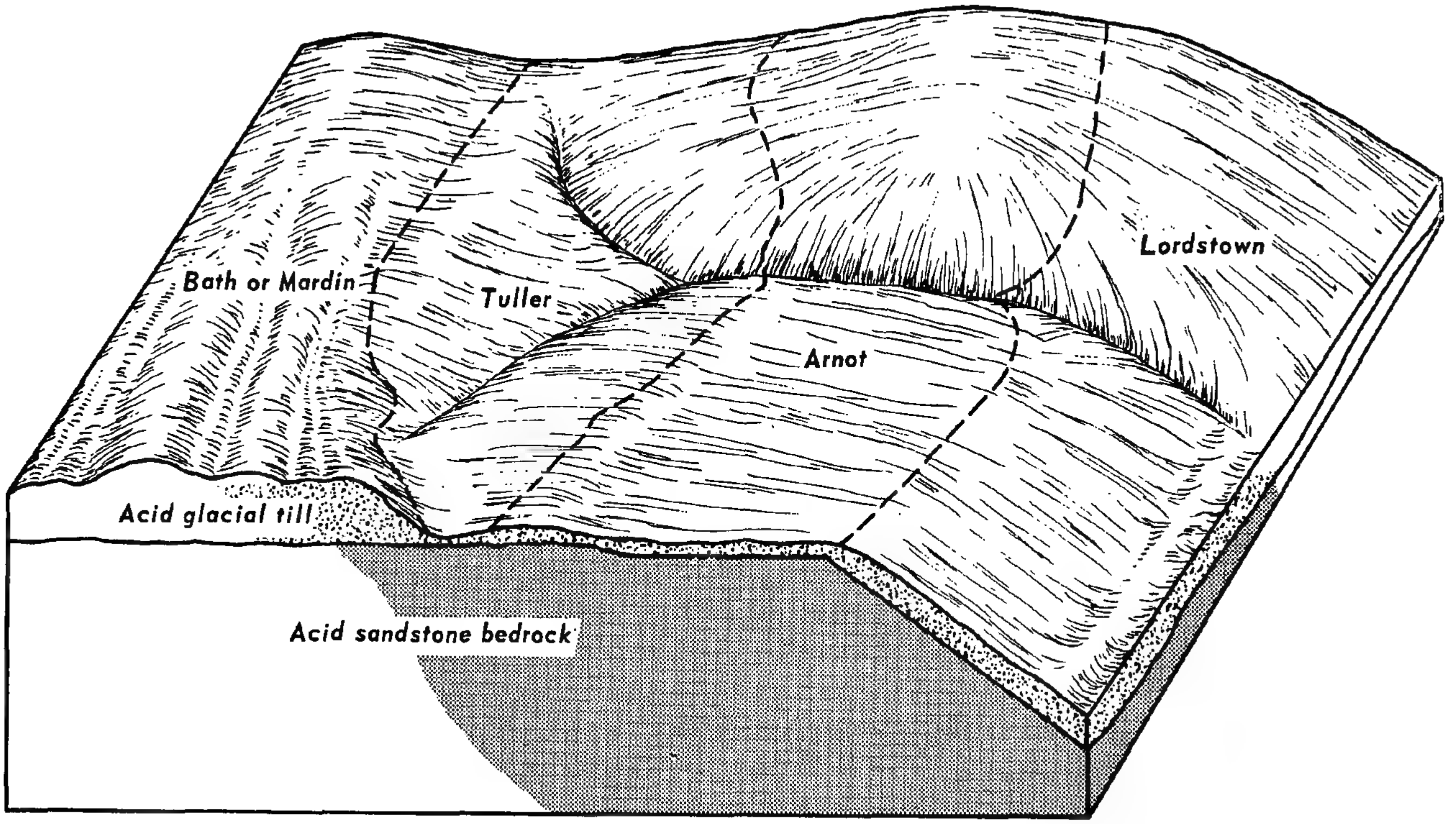

Figure 6.—**Typical pattern of soils in association 10.**

The moderately well drained, very low lime Castile soils formed in outwash derived mainly from sandstone and shale.

Minor soils are those soils that formed in outwash or alluvium and other soils on old stream terraces. They are mainly the somewhat poorly drained Red Hook and Homer soils, the moderately well drained Phelps and Scio soils, the well-drained Allard soils, the well-drained to excessively drained Palmyra soils, and the poorly drained to very poorly drained Halsey and Papakating soils.

Generally, the very low lime Chenango, Castile, and Red Hook soils are dominant on the terraces in valley floors at higher elevations. Examples of these are the terraces along East Koy, Wiscoy, and Cattaraugus Creeks. Medium-lime Howard, Phelps. and Homer soils are on terraces in valleys at lower elevations, such as those along Buffalo and Cayuga Creeks. The high-lime Palmyra soils are limited to terraces around the village of Attica and the hamlet of Pearl Creek.

Some of the best farmland in the county is in this association. Potatoes are grown mainly on the Allard, Castile, and Chenango soils, and cash-grain crops are commonly grown on the Howard, Palmyra, and Phelps soils. Wetter soils of this association generally are difficult to drain adequately because of lack of outlets, but crops do exceedingly well in drained areas.

The drier areas of this association provide excellent homesites. Good onsite water supply and sewage effluent disposal are available on these soils. Some of the soils are sources of sand and gravel.

12. Howard-Chenango association

Deep, well-drained and somewhat excessively drained, medium-lime and very low lime soils that have a medium-textured and moderately coarse textured very gravelly subsoil; on outwash kames

This association is in hilly, kettle-kame areas associated with lateral and terminal moraine glacial outwash. The most striking feature of this association is its complex topography. The soils are gently sloping to steep, and slopes generally are short and choppy. The largest area is in the headwater area between Buffalo and Tonawanda Creeks. Other areas of this association are near Bennington, Attica, and Silver Springs. The soils in this association formed in stratified glacial outwash.

This association makes up about 4.1 percent of the county. Howard soils make up about 38 percent of the association; Chenango soils, about 30 percent; and minor soils, the remaining 32 percent.

The medium-lime Howard soils are well drained and somewhat excessively drained. The Howard soils near Bennington contain many soft shale fragments, but the remaining areas of Howard soils contain a mixture of hard limestone and sandstone gravel.

The very low lime, well-drained and somewhat excessively drained Chenango soils are dominated by sandstone gravel.

Minor soils are the well-drained Madrid and Valois soils that formed in gravelly till and small areas of soils that generally are wetter than the Madrid and Valois soils.

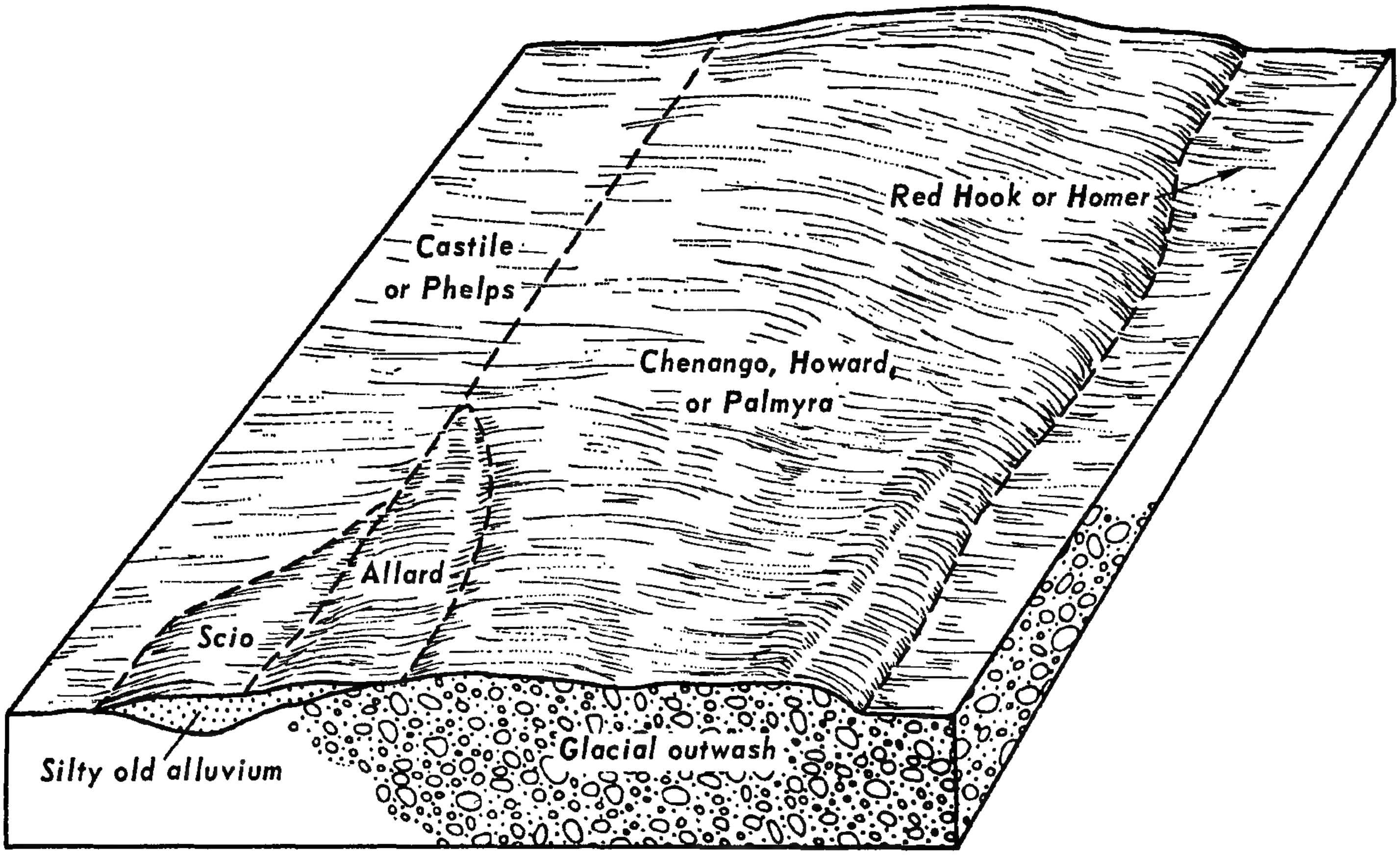

Figure 7.—Typical pattern of soils in association 11.

Some areas of this association are suitable for farming. It is difficult to operate tillage equipment, however, in many areas of the association.

Some areas in this association provide excellent homesites. Most of the soils are dry and provide favorable filtration for sewage disposal. The onsite water supply generally is good. Grading is necessary in many areas of the association, but the soils are easy to manage. Most of the Chenango and Howard soils, except for the Howard soils that are shaly, are good potential sources of sand and gravel.

13. *Herkimer-Wayland-Wallkill association*

Deep, well-drained to very poorly drained, medium-lime to high-lime soils that have a medium-textured and moderately fine textured subsoil; on outwash fans and flood plains

This association (fig. 8) is on the floors of three areas of U-shaped valleys. The largest area is mostly in the Oatka Valley between the town of Warsaw and the village of Wyoming, but this area also includes a small valley near the hamlet of Pearl Creek. Another area is in the Little Tonawanda Valley and extends northward from the hamlet of Dale to within a half mile of the Genesee County line. The smallest area is in the town of Sheldon in the Sheldon Creek Valley.

This association makes up about 2.5 percent of the county. Herkimer soils make up about 30 percent of the association; Wayland soils, about 20 percent; Wallkill soils, about 14 percent; and minor soils, the remaining 36 percent.

The deep, well drained to moderately well drained, medium-lime Herkimer soils have a medium-textured subsoil that is underlain by very shaly outwash material. These soils are nearly level to gently sloping and are on outwash fans on both sides of the valleys where streams enter, generally through deep dissections in the steep Manlius-Lordstown association. These steep valley sides in the Manlius and Lordstown soils form the uprights of the U-shaped valleys.

The deep, poorly drained to very poorly drained, high-lime Wayland soils are medium textured and formed in recent deposits of alluvium on the flood plains in the area.

The very poorly drained Wallkill soils are similar to the Wayland soils but consist of 16 to 40 inches of recent deposits of mineral soil that formed in alluvium and is underlain by muck.

Minor soils are the silty Scio soils that are in some of the outwash fan areas in the Sheldon Creek Valley and other soils that formed in alluvium on flood plains, such as the moderately well drained to somewhat poorly drained Teel soils and the well-drained Hamlin soils. Old slackwater areas above the present flood plains contain fine-textured, somewhat poorly drained to moderately well drained Caneadea soils and poorly drained Canadice soils.

Most areas of the Herkimer soils and the drier soils that

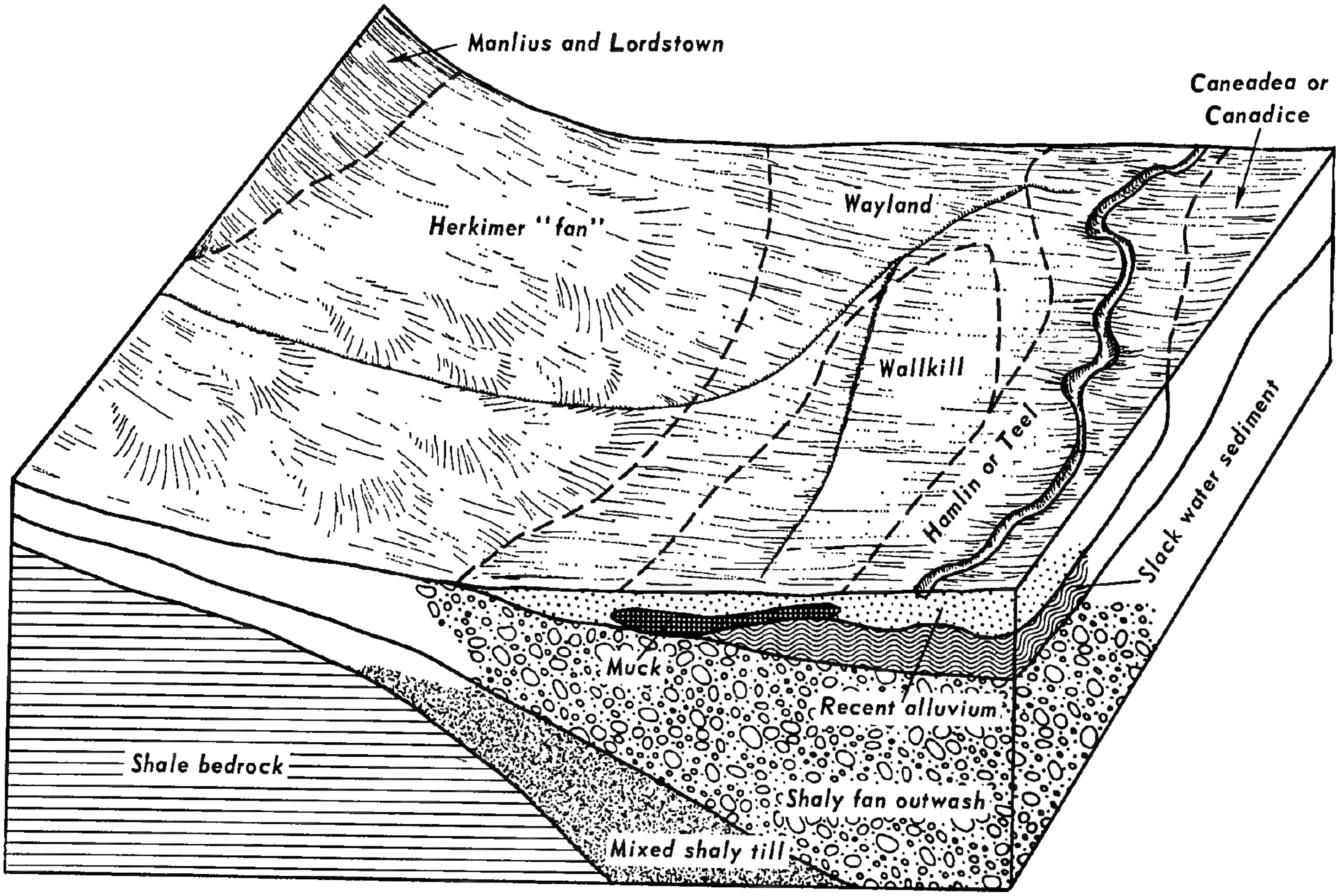

***Figure 8.*—Typical pattern of soils in association 13.**

formed in alluvium are cleared and used for cash-grain or dairy farming. The Herkimer soils on fans along a valley side commonly merge with each other to form a continuous undulating foot slope below the steep valley wall. The main roads and railroad that parallel the valley are on these fans, and the villages of Wyoming and Warsaw are mostly on very large areas of these fans.

The Herkimer soils are well suited to residential development, but the low-lying soils that formed in alluvium are flooded annually.

14. Halsey-Palms-Papakating association

Deep, very poorly drained and poorly drained, medium-lime soils that have a moderately coarse textured to moderately fine textured mineral subsoil or an organic layer; on outwash terraces and flood plains

This association is in depressional pockets of the higher valleys and includes mucky areas adjacent to Silver Lake and Java Lake. Wet soils are dominant, but mounds and bars of gravelly drier soils are common.

This association makes up about 1.7 percent of the county. Halsey soils make up about 25 percent of this association; Palms soils, about 25 percent; Papakating soils, about 25 percent; and minor soils, the remaining 25 percent.

The poorly drained and very poorly drained Halsey soils are deep, wet, and gravelly. These soils are in depressional areas on gravelly outwash and stream terraces at slightly higher elevations than the other soils in the association.

The very poorly drained Palms soils consist of deposits of organic material in depressions. The deposits are from about 1½ to 4 feet thick over mineral soil.

The poorly drained and very poorly drained Papakating soils are wet and medium textured. These soils are on flood plains along the small streams that flow through the area.

Minor soils are mounds and bars of gravelly, well-drained to somewhat excessively drained Chenango or Howard soils; moderately well drained Castile or Phelps soils; and somewhat poorly drained Red Hook or Homer soils that formed in glacial outwash.

Some areas of the association have been developed for wetland wildlife habitat and conservation areas. Few areas of this association can be drained enough to be used for any other purpose because of the lack of suitable outlets.

Soils Formed in Glacial Lake Sediment

The one association in this category is mainly on headwater areas and valley sides of the larger streams. This association makes up about 2 percent of the county. The

soils are deep and formed in deposits of glacial lake clay and silt. They are nearly level to very steep and have medium to high content of lime. These soils have a medium-textured and moderately fine textured surface layer and a fine-textured subsoil. Drainage ranges from somewhat poor to moderate. Dairying is the major farm enterprise. Most of the steeper areas are idle.

15. Caneadea association

Deep, somewhat poorly drained and moderately well drained, medium-lime to high-lime soils that have a moderately fine textured to fine textured subsoil; on glacial lake deposits

This association is made up of four areas of deep, glacial, lake clay sediment. These thick, stone-free, clayey areas commonly are deeply dissected by streams that drain the area. The largest area is in the headwater region of Buffalo Creek in the town of Java. Two areas are in the Tonawanda Creek Valley—one is about halfway between the villages of Attica and Varysburg and the other just upstream from Johnsonburg. The fourth area is in the extreme southeastern part of the county along the Genesee River.

This association makes up about 2.1 percent of the county. Caneadea soils make up about 75 percent of the association and minor soils the remaining 25 percent.

The somewhat poorly drained to moderately well drained Caneadea soils are gently sloping to steep. The steeper soils are dominant.

Minor soils that formed in lake-laid material are silty. They are the moderately well drained Collamer and Williamson soils and the somewhat poorly drained Niagara soils. Other minor soils formed in alluvium in small areas or are on glacial outwash terraces along the streams that cross the areas.

Most areas of this association were originally cleared and farmed, but only the more favorable slopes are now cultivated. The hazard of sheet and gully erosion is severe on the steeper soils, and most areas of these soils are idle.

The dominant soil in this association is poorly suited to many nonfarm uses. It is seasonally wet, slowly permeable, and highly erodible and unstable. The steepness of soils in this association is a deterrent for many uses.

Soils Formed in Contrasting Glacial Deposits

The soil associations in this group are mainly in undulating, hilly, morainic areas on the uplands and kame valley fringe areas in the southern part of the county. They make up about 19 percent of the county. The soils are deep, and they formed in various combinations of multiple deposits of glacial till, glacial outwash, and glacio-lacustrine and aeolian sediments. They are nearly level to steep and have very low lime to high-lime content. The surface layer and subsoil have variable textures within short distances. Drainage ranges from somewhat excessive to somewhat poor. Dairying is the major farm enterprise, but some potatoes are grown. Many areas that have adverse topography or that are severely eroded are idle. Engineering uses of the soils in this group require careful investigation because of the extreme variability of characteristics within short distances.

16. Bath-Valois association

Deep, well-drained, very low lime soils that have a medium-textured and moderately coarse textured subsoil; on morainic uplands

This association (fig. 9) is in undulating, rolling, and hilly morainic areas on the glacial till plain. The major soils in this association are deep, well drained, and very low in lime content. They are intermingled in undulating to hilly morainic areas. Most of this association is in central and southeastern Wyoming County.

This association makes up about 9.7 percent of the county. Bath soils make up about 30 percent of the association; Valois soils, about 25 percent; and minor soils, the remaining 45 percent.

Bath soils have a moderately expressed, medium-textured fragipan at a depth of about 18 to 34 inches. Most areas of the Bath soils in the county formed in firm basal till derived mainly from sandstone and shale. In this association, however, many areas formed in sloughed till underlain by loose, water-sorted sand and gravel.

The Valois soils have a medium-textured and moderately coarse textured subsoil, and they formed in loose, water-worked ablation till that is poorly sorted. These soils are like the Bath soils in that many areas are underlain by well-sorted, gravelly and sandy glacial outwash.

Minor soils are mainly (1) the deep, well-drained to somewhat excessively drained, very low lime Chenango soils that formed on gravelly and sandy glacial outwash terraces and kames and (2) soils that formed in glacial till that has a mantle of about 18 to 30 inches of windblown or water-deposited silt. These include the deep, well drained and moderately well drained Canaseraga soils and the somewhat poorly drained Dalton soils. Other minor soils are the Ellery, Mardin, Sun, and Volusia soils that formed in glacial till; very small areas of soils on flood plains; and wetter soils on glacial outwash in the valley, that cross the area. Near Letchworth State Park are areas of sandy Arkport soils.

Some of the more suitable farming areas in the county are in this association. The proportion of well-drained soils to less well drained soils is relatively high. The two features that limit intensive farming operations are the wet soils that are commonly in depressions and drainageways and the hilly, moderately sloping and strongly sloping soils associated with about half of the drier areas. Potato growing and dairy farming are the main farming uses of the soils. Heavy applications of lime are needed for legume crops, because Bath and Valois soils are strongly acid. Late in summer and early in fall, frost pockets are common in the central part of the county. Near Letchworth State Park several areas are in apple orchards.

Dry homesites are in many areas of this association. Grading is needed to develop some of the hilly areas for residences. Soils in some areas are good sources of gravel.

17. Howard-Madrid association

Deep, well-drained and somewhat excessively drained, medium-lime soils that have a medium-textured and moderately coarse textured subsoil that is very gravelly in places; on kamy outwash and adjacent morainic uplands.

This association is on undulating, rolling, and hilly moranic till and in kamy outwash areas of valleys and adjacent uplands. Most areas of this association are in the south-

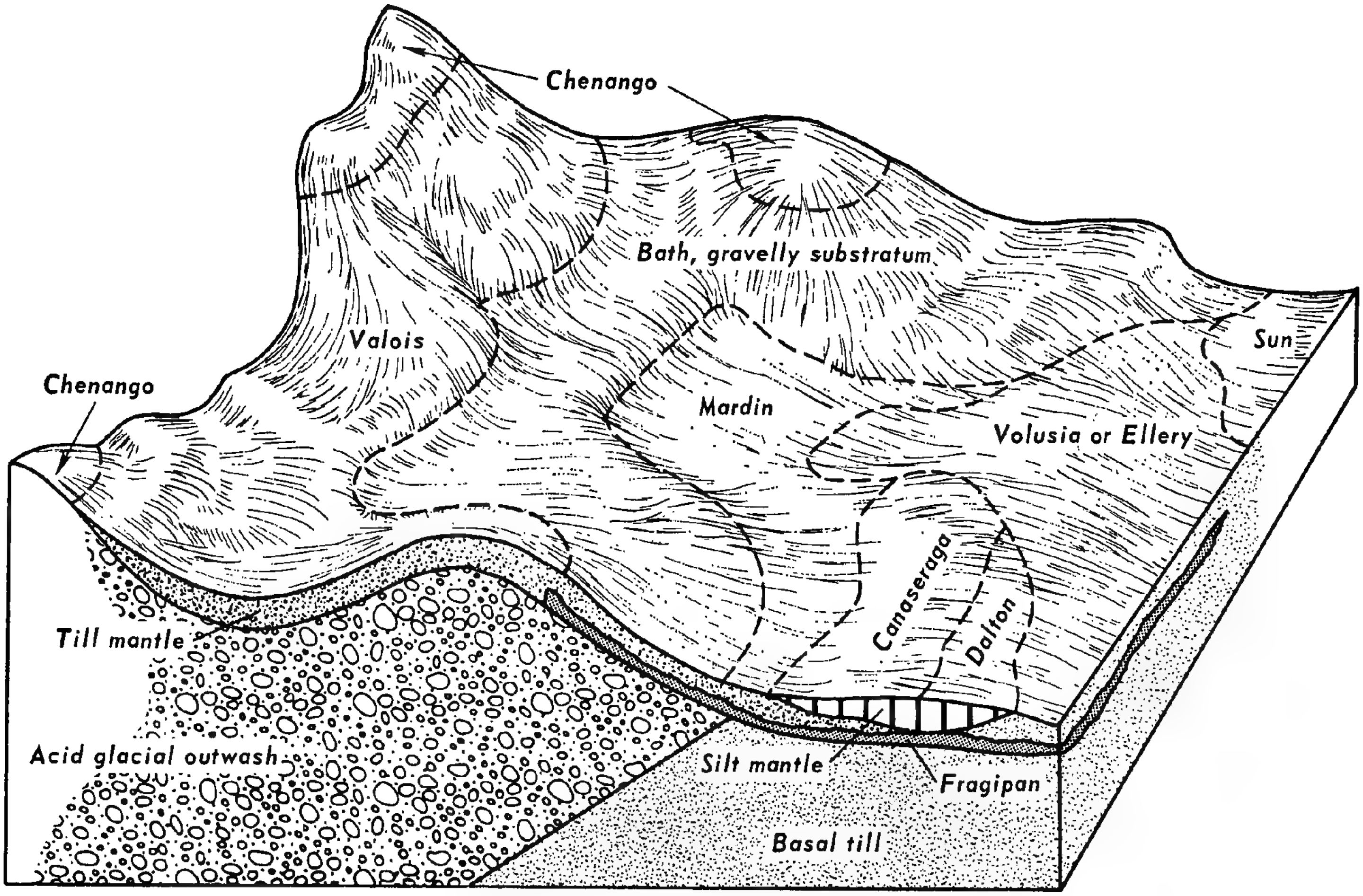

***Figure 9.*—Typical pattern of soils in association 16.**

western part of the county. Small areas are in the towns of Bennington, Gainesville, and Perry.

This association makes up about 5.2 percent of the county. Howard soils make up about 35 percent of the association; Madrid soils, about 25 percent; and minor soils, the remaining 40 percent.

The well-drained to somewhat excessively drained, medium-lime Howard soils formed in gravelly and sandy glacial outwash kames where the degree of sorting is variable. They are intermingled with the Madrid soils that are on adjacent morainic glacial till deposits. Howard soils, like Madrid, have a medium-textured to moderately coarse textured subsoil, which contains much more gravel than that of Madrid soils.

The well-drained, medium-lime Madrid soils formed in firm basal till in some areas, but in most areas they formed in ablation till of moraines or on sloughed till underlain by well-sorted gravelly and sandy glacial outwash. In the moraine till there has been some water working, but the sorting is poor.

Minor soils are mainly the deep, well-drained, very low lime Valois soils that are similar to the Madrid soils but more acid. These soils occupy a position on the landscape similar to that of the Madrid soils. Other minor soils are the deep, moderately well drained and well drained Langford soils and the somewhat poorly drained Erie soils. These soils have a strongly expressed fragipan that impedes drainage and rooting. Langford and Erie soils are gently sloping and are in the smooth interior areas of the association. The remaining minor soils are the wetter Alden and Ellery soils in depressions and along drainageways and a few pockets of Palms soils.

The Howard and Madrid soils that have favorable slopes are well suited to crops. In places depressions and drainageways hinder cultivation. Soils in hilly areas have irregular slopes that limit effective use of stripcropping and contour farming. Deep-rooted legume hay crops are well suited because most plant roots respond well to the favorable lime content in the lower part of the subsoil.

The Howard and Madrid soils in this association provide dry homesites. Grading is necessary to develop the more hilly soils for residential use. A few areas are good sources of gravel and sand, but most are only fair.

18. Varysburg-Williamson-Churchville association

Deep, well-drained to somewhat poorly drained, very low lime to high-lime soils that have a medium-textured to fine-textured subsoil; on valley-side deposits

This association (fig. 10) is on side slopes along the main valleys. It is a zone where ice-contact material and glacial lake sediment merge. It has the most diversified soil pat-

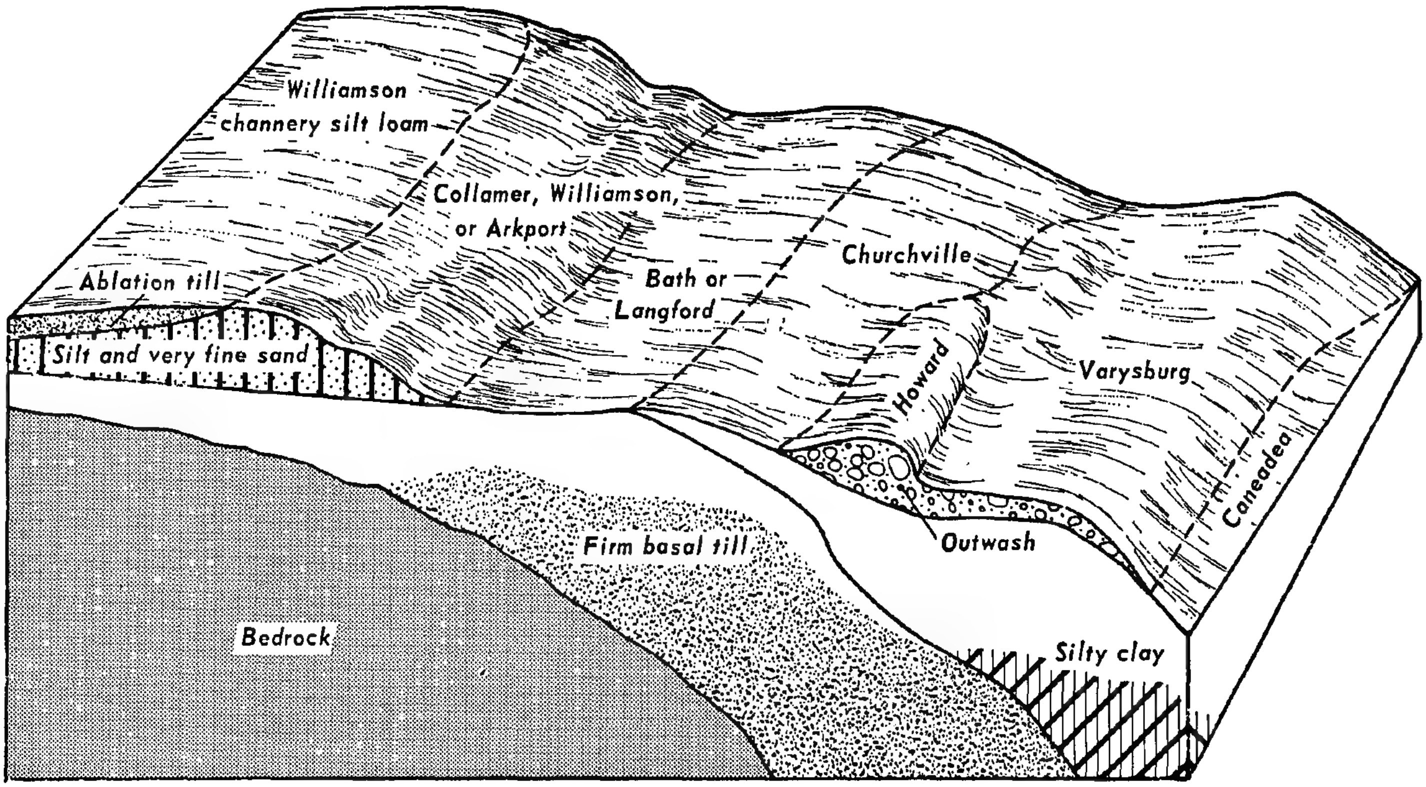

Figure 10.—Typical pattern of soils in association 18.

tern of any association in the county. The soils in this association are gently sloping to moderately steep.

This association makes up about 3.9 percent of Wyoming County. Varysburg soils make up about 20 percent of the association, Williamson soils, about 20 percent; Churchville soils, about 14 percent; and minor soils, the remaining 46 percent.

The deep, well drained and moderately well drained, medium-lime Varysburg soils have a medium-textured to fine-textured subsoil. These soils formed in deposits of gravelly glacial outwash, 20 to 40 inches thick. They are underlain by glacial lake deposits of clay and silt. Varysburg soils are gently sloping to moderately steep and are mainly along valley sides.

The deep, moderately well drained, very low lime Williamson soils formed in silty lake-laid deposits or in areas where the silty deposits are overlain by a mantle of medium-textured, channery ablation till about 14 to 34 inches thick. These soils have a firm, brittle, silty fragipan that impedes drainage and restricts rooting. They are gently sloping to moderately sloping, and they are intermingled with Varysburg soils.

The deep, somewhat poorly drained, high-lime Churchville soils have a fine-textured, slowly permeable subsoil. These soils formed in 20 to 36 inches of glacial lake clay deposits over loamy till. They generally are gently sloping and are in areas along the upper fringe where valley fill material abuts the uplands.

Minor soils are the deep, moderately well drained, medium-lime, silty Collamer soils; the Bath, Langford, and Valois soils that formed in glacial till; the Howard soils that formed in glacial outwash; the sandy Arkport soils and clayey Caneadea soils that formed in glacial lake sediment; and the silty Allard soils that formed in stream terrace deposits. A mixture of soils of very minor extent are on the flood plains that cross the areas.

Most areas of the association have been cleared and are used mainly for crops used in dairy farming. Controlling erosion is a concern of management because most soils occupy parts of long slopes, and large areas of the soils are very erodible. An increasing acreage of this association is being left idle.

A few areas provide good homesites in this association, but most of the soils are moderately to seriously limited for many nonfarm uses. Bearing strengths are extremely variable within very short distances, and highway locations and building foundations require careful investigation. Slippage of side slopes is prevalent in at least half of the areas.

Use and Management of the Soils

The first part of this section discusses the use of soils for crops and pasture. The soils are grouped into capability units to show their relative suitability for farming, and suggestions for the use and management of the soils in each capability unit are given. Included in this section is a table showing estimated average acre yields obtained from each of the soils at different levels of management. In addition, soils are grouped according to their suitability for use as woodland, and soil interpretations for wildlife habitat are

discussed. This section also presents information about soil properties that are important to engineers and builders, and, finally, it rates the soil for selected community development and recreational uses.

Use of Soils for Crops and Pasture [1]

This section is designed to help farmers, and those who advise farmers, choose combinations of soil, water, and crop management practices that are economical and suitable and appropriate for conditions prevailing at the time the choices are made. Before making his choice, the user of this survey should consider the latest information on soil and crop management. Cornell Miscellaneous Bulletin Number 47 and current editions of other applicable publications on soil and crop management will be useful for this purpose. Up-to-date information is available upon request from the local office of the Soil Conservation Service and the Cooperative Extension Service.

Subsoil characteristics that affect root growth

The characteristics of the subsoil or underlying material of a given soil need to be considered in choosing a crop to be grown on that soil. These characteristics are given for each soil in the section "Descriptions of the Soils."

In some soils, such as Chenango, Hamlin, and Tioga, the subsoil is loose and roots can easily penetrate to a great depth. In other soils, such as Mardin, Marilla, Dalton, Erie, and Volusia, a dense fragipan at a depth of 10 to 25 inches restricts drainage and roots. The Arnot and Tuller soils are underlain by bedrock at a depth of 20 inches or less. In some soils where the movement of air and water is restricted by a slowly permeable clay layer or by dense till, root penetration is also restricted.

Figure 11 shows the typical root zone where the soil is well drained and where drainage is moderate, somewhat poor, and poor.

[1] By E. L. McPherron, agronomist, Soil Conservation Service. Unless otherwise noted, the material is based on the results of research studies performed on the Aurora and Mount Pleasant Research Farms by staff members and associates of the New York State College of Agriculture at Cornell University.

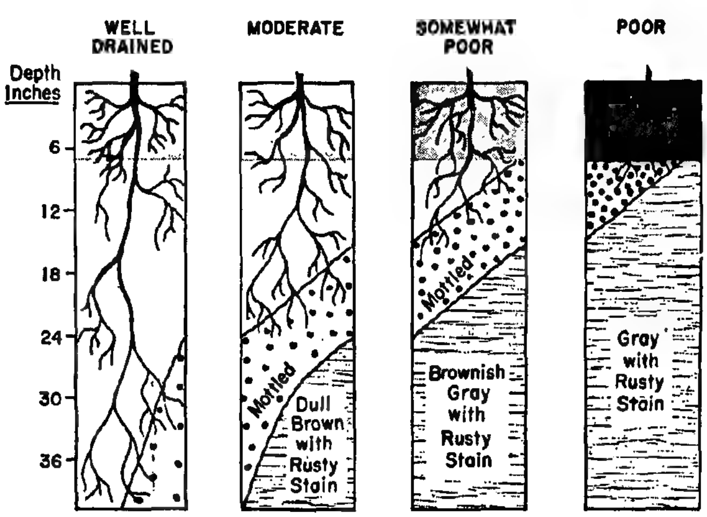

Figure 11.—Effect of soil drainage on root growth.

Acidity relationships in the soils

The natural lime content of Wyoming County soils ranges from high to very low. Medium-lime soils, such as Howard, are acid to a depth of more than 12 inches, but they become less acid below that depth. These soils generally have free lime at a depth of 36 to 48 inches. Low-lime soils, such as the Langford and Erie, are very strongly acid to medium acid to a depth of more than 24 inches. In some places they have neutral material deep in the subsoil or substratum that commonly is beyond the reach of plant roots.

Lime moves downward at an average rate of half an inch each year in silt loam, which is the most common texture in the surface layer in this county. Crops also deplete lime. Therefore, to maintain the desired reaction in the plow layer, it is necessary to apply lime periodically.

Nutrient relationships in the soils

Soils contain different amounts of plant nutrients. These are the result of biological and chemical actions that take place in different kinds of parent material during the soil-forming process. In this survey, references to fertility mainly apply to the inherent ability of the soils to supply phosphorus and potassium.

The ability to supply plant nutrients is related to clay and organic-matter content. Generally, the finer the soil texture is in the rooting zone, the greater the ability to supply plant nutrients.

All of the soils of Wyoming County require additions of lime and fertilizer for good crop response. The amounts applied should be based on complete soil tests. These tests can be used as a guide for matching applications of lime and fertilizers to specific crops.

Nitrogen relationships in the soils

The average organic-matter content of the surface layer of soils on uplands in this county is 4 percent. This percentage was obtained from soil tests. Nitrogen is released from this organic matter at the rate of 40 to about 160 pounds per acre each year. Poorly drained soils that warm up slowly benefit in places from additional nitrogen in spring.

Phosphorus relationships in the soils

Most soils in this county can supply medium amounts of phosphorus, generally the equivalent of 10 pounds of phosphate per acre each year. The addition of appropriate amounts of phosphate in the form of commercial fertilizer is essential for good crop growth.

Potassium relationships in the soils

Most soils in Wyoming County are medium or low in ability to supply potassium. Those that have medium ability generally supply less than 70 pounds. Medium-textured soils, such as the Mardin and Lordstown, have medium ability to supply potassium.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does

not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute of interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife. (No soils in Wyoming County are in Class V.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes. (No soils in Wyoming County are in Class VIII.)

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral; for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use.

Capability Units are soil groups within the subclasses. All the soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to be similar in productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units generally are designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within the subclass.

Management by capability units

In the following pages each of the capability units in Wyoming County is described, and suggestions for the use and management of the soils in each unit are given. The names of soil series represented are mentioned in the description of each group, but this does not mean that all the soils of a given series are in the group. The "Guide to Mapping Units" at the back of this survey shows which group each individual soil is in.

CAPABILITY UNIT I-1

This unit consists of deep, generally well drained, nearly level, medium-textured soils on glacial stream terraces and uplands. These soils are in the Allard, Bath, Herkimer, and Valois series. All the soils are well drained except for the Herkimer soils, which are well drained to moderately well drained. Bath and Valois soils have many hard pebbles or channery fragments in the surface layer, and Herkimer soils are dominated by shales. Allard soils are free of stones in the surface layer. The soils in this unit are very strongly acid or strongly acid in the surface layer, except the Herkimer soils, which are medium acid to neutral in the surface layer.

Permeability in these soils is moderate to moderately rapid in the root zone, which extends to a depth of 24 inches or more in all except Bath soils. Bath soils have a fragipan that restricts root penetration to a depth of about 18 to 34 inches. Available water capacity generally is moderate, but it ranges to high in the Allard soils.

The soils in this unit are well suited to all crops commonly grown in the county, and they are well adapted to deep-rooted crops, except for Bath soils. Cultivated row crops grown in a cropping system generally are more valuable than permanent pasture or woodland. These soils respond well to good management. In places irrigation is needed in some years to maintain high-quality vegetables. Water can be applied with little or no crusting and sealing on all but Allard soils. All except Allard soils can be cultivated soon after irrigation, because there is little or no danger of compaction.

Herkimer soils need relatively small amounts of lime compared to the other soils in this unit. All crops in the county, especially legumes, need lime and fertilizer. Except for Allard soils, surface stones interfere with machinery used to cultivate and harvest vegetable crops in places. Row crops can be grown repeatedly if the content of organic matter is maintained and if soil structure is preserved. Annual use of crop residue and cover crops or growing an occasional sod crop helps to maintain the content of organic

matter. Keeping tillage to a minimum also helps to preserve soil structure.

CAPABILITY UNIT I-2

This unit consists of deep, well-drained, nearly level, medium-textured soils on flood plains. These soils are in the Hamlin and Tioga series. They are free of stone fragments.

Permeability in these soils is moderate in the root zone, which generally is unrestricted. The available water capacity is high. Hamlin soils are slightly acid to neutral in the surface layer, and Tioga soils are strongly acid to medium acid. These soils are subject to flooding, but they rarely are flooded during the growing season. The most serious hazard of flooding is in the Oatka and Tonawanda Valleys.

The soils in this unit are easy to work and can be tilled early in spring. They are well suited to all crops grown in the county, including vegetables. They are well suited to deep-rooted crops. Generally, these soils are more suitable for intertilled crops than for pasture. They respond well to good management and are among the most productive soils in the county. They are suited to irrigation because of nearness to a source of water, depth, and permeability. Irrigation water can be applied at a moderate rate. Moderate amounts of lime and some phosphorus and potassium are needed on Tioga soils for good crop response.

Row crops can be grown for several years if the content of organic matter is maintained and if soil structure is preserved. Minimum tillage coupled with annual use of crop residue and cover crops or occasionally growing a sod crop helps to maintain the content of organic matter and preserve soil structure.

CAPABILITY UNIT IIe-1

This unit consists of deep, generally well-drained, gently sloping, medium-lime to low-lime soils in the Herkimer, Lansing, and Madrid series. All the soils are well drained, except for Herkimer soils, which are well drained to moderately well drained. Few to moderate amounts of pebbles and shale fragments are on the surface of these soils.

Permeability in the root zone, which extends to a depth of 24 to 30 inches or more, is moderate to moderately rapid in the Herkimer soils, and moderate in the Madrid and Lansing soils. The available water capacity is moderate to high. Natural fertility is medium to high in the Herkimer and Lansing soils and low in the Madrid soils. The hazard of erosion is slight to moderate.

The soils in this unit are well suited to most forage and field crops commonly grown in the county. They are among the better suited soils for farming. They are easy to till and can be used for all kinds of crops. Forage mixtures with deep-rooted legumes grow very well. Vegetables can also be grown, but stoniness interferes with the operation of some machinery in places. Crops respond to applications of lime and fertilizer. Applications should be based on crop needs.

The soils in this unit should not be continuously cultivated to row crops; however, they can be cultivated frequently if erosion is controlled. Contour stripcropping, grassed waterways, and other measures are needed to help control erosion if row crops are grown on long or steep slopes. Diversions can be constructed on long slopes if the soils are used intensively for row crops. Crops that provide a cover in winter help to maintain a good soil structure. Keeping tillage to a minimum on short, complex slopes and using crop residue with no-plow tillage help to control erosion. The supply of water for irrigation is limited in places, but these soils take in water at a moderate to rapid rate.

CAPABILITY UNIT IIe-2

This unit consists of deep and moderately deep, generally well-drained, gently sloping, medium-textured, low lime to very low lime soils. These soils are in the Bath, Lordstown, Manlius, and Valois series. All the soils are well drained, except for the Manlius soils, which are well drained to excessively drained. These soils have moderate amounts of gravelly, shaly, and channery fragments on the surface.

Bedrock is at a depth of 20 to 40 inches in the Lordstown and Manlius soils, and this is generally the range of depth of root penetration in the soils of this unit. Premeability in these soils is mainly moderate, but it ranges to moderately rapid in the Valois soils. The available water capacity is moderate to low. The hazard of erosion is moderate.

The soils in this unit are well suited to crops commonly grown in the county, but the restricted root zone hinders crop growth in places. Lime is needed for most crops, especially legumes. Crops respond well to applications of fertilizer. Fragments on the surface of these soils interfere with the operation of precision machinery needed for cultivation of fine-seeded crops, but transplanted crops grow well.

These soils should not be continuously cultivated, and, unless measures to control erosion are used, sod-based cropping systems are needed. Contour tillage, contour stripcropping, and the use of diversions to break long slopes help to control erosion and loss of water. Measures are needed to increase infiltration, mainly during the growing season. Crops that provide winter cover are helpful. Keeping tillage to a minimum and using crop residue help to control erosion.

CAPABILITY UNIT IIe-3

This unit consists of deep, well-drained, gently sloping, medium-textured soils. These soils are in the Allard and Arkport series.

Permeability generally is moderate to rapid in the root zone, which extends to a depth of 24 inches or more. Available water capacity is moderate to high in the Allard soils and moderate to low in the more sandy Arkport soils. All soils in this unit are very erodible. Natural fertility is low to medium. The content of organic matter is low.

The soils in this unit are well suited to crops and pasture. These relatively stone-free soils are well suited to vegetable crops. In nonirrigated areas deep-rooted crops grown in a cropping system are better suited than other crops. In places shallow-rooted crops need supplemental irrigation. Slopes limit use of precision machinery in some areas. These acid soils need lime and fertilizer if they are used for crops. Applications of lime and fertilizer should be based on crop needs, as indicated by tests.

If these soils are cultivated, measures are needed that help to control erosion. Contour tillage and contour stripcropping are effective, but terraces can be constructed if the soils are used intensively. Keeping the areas protected most of the time helps to control soil blowing and water erosion. Returning crop residue to the soil, growing sod crops in a cropping system, and growing crops that provide winter cover are ways to maintain desirable soil struc-

ture. Keeping tillage to a minimum and using crop residue help to control erosion. In places irrigation is needed in dry years to assure satisfactory growth of truck crops.

CAPABILITY UNIT IIe-4

This unit consists of deep, generally moderately well drained, gently sloping, medium-textured soils. These soils are in the Castile, Conesus, Phelps, and Varysburg series. All the soils are moderately well drained except for the Varysburg soils, which are well drained to moderately well drained. All soils in this unit have a gravelly surface layer.

Permeability in the root zone, which generally extends to a depth of 20 to 30 inches, is moderate in Conesus and Phelps soils and moderate to moderately rapid in the other soils. Natural fertility is low to medium in Castile, Phelps, and Varysburg soils and medium to high in Conesus soils. Available water capacity is low to moderate in all but the Conesus soils, which are moderate to high. The hazard of erosion is slight to moderate.

The soils in this unit are well suited to crops commonly grown in the county. In places, surface stones interfere with precision machinery needed for tillage of truck crops. Slight wetness may delay planting for short periods in spring, but these soils are easy to work. Irrigation water needs to be applied at a moderate rate if it is used on shallow-rooted, late-season crops.

Moderate erosion control is needed. If measures to control erosion are not used, sod-based cropping systems are necessary. Contour tillage and the use of crop residue allow more intensive use of these soils by conserving moisture and checking soil losses on long slopes. Terraces, diversion ditches, and contour stripcropping also help to control erosion and conserve moisture. Keeping tillage to a minimum and growing crops that provide cover in winter help to maintain tilth and control soil loss.

CAPABILITY UNIT IIe-5

This unit consists of deep, mainly moderately well drained, gently sloping soils that have a silty surface layer and a stone-free surface. They are in the Canaseraga, Collamer, Danley, Nunda, Scio, and Williamson series. All the soils are moderately well drained, except for the Canaseraga soils, which are moderately well drained to well drained. Canaseraga and Williamson soils have a dense fragipan in the subsoil. Nunda and Danley soils have a subsoil of shaly silty clay loam or clay loam, and the Collamer and Scio soils have a subsoil of firm to friable silt.

Permeability in the root zone, which generally extends to a depth of 20 to 30 inches, is moderate or moderately slow to slow. Available water capacity is moderate to high. Lime needs are variable. All the soils are very erodible. Natural fertility generally is medium to low, but potassium reserves are higher in the subsoil of the Danley and Nunda soils than they are in the remaining soils.

If properly managed, these stone-free soils are well suited to all crops commonly grown in the county. Lime is needed for most crops, and crops respond well to applications of lime and fertilizer. In places the soils in this unit are slightly wet in spring and need careful management to reduce crusting, erosion, and compaction. Good soil structure is difficult to maintain. These soils should not be plowed or fitted when they are wet. Keeping tillage to a minimum, using an occasional sod crop in the cropping system, returning crop residue to the soil, and providing a cover in winter are other measures for maintaining tilth.

Drainage of wet areas by surface smoothing and random tile systems help to make these soils more suitable for all crops. Good management practices that include using crop residue and keeping tillage to a minimum help to effectively control erosion on gently sloping soils. On steeper and longer slopes, however, a combination of practices is needed. Such practices as terracing, contour stripcropping where topography permits, and maintaining surface cover throughout the year are helpful. If cultivated areas are not protected, the maximum intensity of use should not exceed 1 year of row crop, 1 year of grain, and 3 years of sod. Irrigation water needs to be applied at a moderate to slow rate and careful management is needed to prevent surface sealing, compaction, and serious soil and water loss.

CAPABILITY UNIT IIw-1

This unit consists of deep, moderately well drained, nearly level soils. These soils are in the Castile, Conesus, Phelps, and Scio series. The Castile and Scio soils are low lime or very low lime soils, and the Conesus and Phelps soils are medium-lime to high-lime soils. All but the Scio soils have moderate amounts of gravelly or channery fragments on the surface.

Root penetration generally extends to a depth of 24 inches, but it extends below this depth in places as the growing season progresses. Permeability is moderate or moderately rapid in the root zone. Available water capacity is low in the Castile soils, but it is well distributed and easily available throughout the root zone. Available water capacity is moderate to high in the remaining soils.

If the soils in this unit are properly managed, they are well suited to most crops grown in the county. Stones interfere in places with precision machinery used for tillage of truck crops on the Conesus, Castile, and Phelps soils. The Scio soils, however, are free of stones and are well suited to truck crops. In places, slight wetness delays planting for short periods in spring, but the soils are easily worked. Wet spots need to be drained so that the fields can be used more uniformly.

Smoothing or shaping permits the free flow of excess surface water from the area. A uniform distribution of moisture on the entire field provides better opportunity to plant in spring as well as to harvest a quality crop. The Scio and Castile soils need relatively large applications of lime, especially for growing legumes. The other soils in this group need applications of lime to help establish legumes. Continuous row crops can be grown if all crop residue is returned to the soil. A cropping system that includes a sod crop every 4 or 5 years helps to maintain soil structure. Erosion generally is not a problem, but keeping tillage to a minimum helps to prevent compaction and sealing of the soil surface.

CAPABILITY UNIT IIw-2

This unit consists of deep, generally moderately well drained, nearly level soils that have a dense, slowly permeable fragipan at a depth of about 14 to 30 inches. These soils are in the Canaseraga, Langford, and Mardin series. In places the Canaseraga and Langford soils are well drained. The Langford and Mardin soils have rock fragments throughout, and the Canaseraga soil has a silty mantle over till.

Root penetration generally is restricted to the zone above the fragipan. Permeability in the root zone generally is moderate. Available water capacity is moderate to low in the Langford and Mardin soils and high in the Canaseraga soils. The Mardin and Langford soils are strongly acid to medium acid in the surface layer, and the Canaseraga soils are strongly acid to very strongly acid. The Langford soils are less acid in the fragipan than the other soils in this unit.

The soils in this unit are well suited to all crops commonly grown in the county. The Canaseraga soils generally are stone free and can be used for vegetables. The Langford and Mardin soils have surface stones that interfere in places with cultivation and harvesting machinery needed for fine-seeded crops. The soils in this unit need large applications of lime for establishing and growing legumes.

The soils in this unit have a fragipan that can cause slight wetness early in spring and droughtiness in midseason, but the effect of the fragipan is less if a good fertility program is followed. Legume and grass mixtures are suitable forage plants on these soils. Maintaining good tilth, using a winter cover to protect the surface layer, and returning crop residue to the soil are helpful. If the wetter soils are drained, management measures are more effective for early planting and production of quality crops. Keeping tillage to a minimum helps to reduce compaction.

CAPABILITY UNIT IIw-3

This unit consists of deep, generally moderately well drained, gently sloping, medium-textured soils. These soils are in the Langford, Mardin, Marilla, and Williamson series. All the soils are moderately well drained, except for the Langford soils, which are well drained in places. All but the Williamson soils formed in deep deposits of glacial till. The Williamson soils formed in deposits of thin till over windblown or lake-laid silts. All the soils have moderate amounts of channery and shaly fragments on the surface, and this helps to control erosion. Except for the Williamson soils, however, slopes generally are long so there is a moderate hazard of erosion. These soils have a dense, very slowly to moderately slowly permeable fragipan at a depth of about 14 to 25 inches.

Root penetration is mainly restricted to the zone above the fragipan, and permeability is moderate in this zone. Available water capacity is moderate to low.

The soils in this unit are moderately well suited to intensive use for row crops. They are well suited to sod crops, grass and legume mixtures, and small grains. Short-season row crops that do not require early planting or late harvesting are desirable. Large applications of lime are needed to grow legumes. In places stone fragments on the surface of the soils limit the selection of row crops grown.

If these soils are used intensively for row crops, measures are needed to control loss of soil and runoff of water. Contour tillage, contour stripcropping, and the construction of diversion terraces are suitable practices. Also, keeping tillage to a minimum, providing a winter cover crop, and returning crop residue to the soil help to protect the surface. The fragipan in these soils causes some wetness in spring and droughtiness in summer, but the effect of the fragipan is less if fertilizer is applied according to soil tests and other good conservation measures are followed. A well-planned water disposal system that effectively controls runoff and drainage of the wetter areas makes these soils more capable of producing crops of high quality.

CAPABILITY UNIT IIw-4

Teel silt loam is the only soil in this unit. This deep, moderately well drained to somewhat poorly drained, nearly level, medium-textured soil is on flood plains.

Root penetration generally is restricted to a depth of 24 inches because of a seasonal high water table, but in places the root zone extends to a depth of 30 inches or more as the water table recedes. Permeability is moderate throughout the root zone. Available water capacity is high, and natural fertility is medium. This soil is easy to work. Flooding occasionally occurs during the growing season.

This soil is suited to most crops commonly grown in the county. Flooding early in spring and a persistent high water table, however, restrict the selection of crops in places. This soil responds well to good management practices and generally is suitable for continuous row crops. Selected perennial crops need to be tolerant of wetness for short periods in spring. Short-season crops and annual forage crops are well suited.

Dikes to control flooding, streambank protection, and channel improvement are needed in some places. Tilth, erosion, and organic-matter content are seldom concerns. This soil is easy to work. In places land shaping is needed to help surface drainage. Winter cover is desirable.

These soils are well adapted to irrigation because of their depth and permeability.

CAPABILITY UNIT IIs-1

This unit consists of deep, well-drained to excessively drained, nearly level soils on glacial outwash and stream terraces. These soils are in the Chenango, Howard, and Palmyra series. They are gravelly in the surface layer and subsoil.

Permeability is rapid or very rapid in the substratum and moderate to moderately rapid in the surface layer and subsoil. Available water capacity is low to moderate. Roots extend to a depth of 30 inches or more in places. Natural fertility is medium in the Palmyra soils, medium to low in the Howard soils, and low in the Chenango soils.

The soils in this unit are easy to work and can be cultivated early in spring. They are suited to all crops commonly grown in the county. Deep-rooted perennial crops are especially well suited. If these soils are properly managed, they are well suited to specialized fruit and vegetable crops. Stones on the surface limit the use of precision machinery, but transplanted crops grow well. Droughtiness and low to medium natural fertility limit crop growth in places. Applications of lime are needed for most crops, especially on the Chenango and Howard soils. Annual applications of fertilizer are needed on all crops.

If these soils are cultivated, returning crop residue to the soil, keeping tillage to a minimum, and providing a cover crop are important practices that help to maintain good tilth.

These soils take irrigation water readily. This water is needed to assure good crop growth, and irrigation needs to be part of a complete treatment for high-value crops. Applications of fertilizer should be based on crop needs as indicated by tests, because these soils leach easily and have low to moderate available water capacity.

CAPABILITY UNIT IIs-2

This unit consists of deep, well-drained to excessively drained, gently sloping soils on glacial outwash and deposits of morainic till. These soils are in the Chenango, Howard, Madrid, and Palmyra series. They generally are gravelly or shaly in the surface layer and subsoil.

Permeability in the surface layer and subsoil is moderate or moderately rapid. Available water capacity is low to moderate in all soils except Madrid, which are high in available water capacity. Root penetration is restricted in only a few places. Natural fertility varies from medium in Palmyra soils to low in Chenango soils. Slopes generally are short and undulating, but some slopes on deltas are smooth. The hazard of erosion is slight to moderate. These soils are easy to work.

The soils in this unit are suited to all crops commonly grown in the county. Deep-rooted perennial crops are especially well suited. If these soils are properly managed, they are well suited to specialized fruit and vegetable crops. Stones on the surface limit the use of precision machinery in places, but transplanted crops grow well. Stands are adversely affected in places by erosion, droughtiness, and low-to-medium natural fertility. Applications of lime are needed for most crops, especially on Chenango, Howard, and Madrid soils. Annual applications of fertilizer to the soils are needed for all crops to maintain stands.

These soils generally are easy to keep in good tilth, but an occasional sod crop is needed to protect the soils from erosion and to maintain the tilth. Contour tillage and contour stripcropping are needed to conserve moisture and control erosion. Complex slopes make these practices impractical in many places. On short complex slopes, keeping tillage to a minimum, using a cover crop, and using crop residue on the surface are important practices that help to control erosion and maintain good tilth. Another practice for conserving moisture and controlling erosion is crop-residue management that is used to supplement other practices in a field where more intensive cropping is desired.

These soils take irrigation water readily. This water is needed to assure good crop growth and its application needs to be part of a complete treatment for high-value crops. Applications of fertilizer should be based on crop needs as indicated by tests, because these soils leach readily and most of them have low to moderate available water capacity.

CAPABILITY UNIT IIIe-1

This unit consists of deep, well-drained to somewhat excessively drained, moderately sloping soils on glacial outwash and till deposits. These soils are in the Chenango, Howard, Lansing, and Madrid series. The content of coarse fragments in the surface layer ranges from few in some of the Madrid soils to many in the other soils.

Root penetration extends to a depth of 30 inches or more in places. Permeability is moderately rapid in the root zone of all except the Lansing and Madrid soils, which have moderate permeability in the subsoil. Available water capacity is low in Chenango soils, low to moderate in Howard and Howard-Madrid soils, and moderate to high in the Lansing soils and those Madrid soils that have fewer coarse fragments. Complex, short slopes are common to many soils of this unit, and the hazard of erosion is moderate to severe.

The soils in this unit are suitable for cultivation and suited to all crops commonly grown in the county. Slope and stoniness, however, limit the intensity of use in places. They are well suited to tree fruits and forage crops that require good drainage and deep rooting. These soils can be planted early; and if erosion is controlled, fruit and vegetables can be grown. Lime and fertilizer are needed on all the soils.

If these soils are cultivated intensively, they are highly susceptible to erosion, but they generally are easy to keep in good tilth. Unless measures are used to control erosion, the maximum intensity of cropping should not exceed 1 year of a cultivated crop, 1 year of a small grain, and 2 years of hay. Runoff is rapid, and measures are needed to conserve soil and water. Long slopes that are contoured or stripcropped can be used more intensively. Growing a crop that provides a winter cover and returning all crop residue to the soil help to maintain the surface soils in place and to maintain a high rate of infiltration. Where slopes are short and complex and contour measures are not practical, the use of crop residue and keeping tillage to a minimum are very important. A suitable cropping system to effectively control erosion is one that permits crop residue to be maintained on the surface of the soil through the use of minimum tillage and no-plow tillage. These soils can take water at a relatively rapid rate, but they are not well suited to irrigation because of the hazard of erosions.

CAPABILITY UNIT IIIe-2

This unit consists of deep and moderately deep, generally well-drained, moderately sloping, medium-textured acid soils. These soils are in the Bath, Lordstown, Manlius, Valois, and Williamson series. All the soils are well drained except for the Manlius soils, which are excessively drained in places, and the Williamson soils, which are moderately well drained in places.

Bedrock is at a depth of 20 to 40 inches in the Lordstown soils and Manlius soils, and root penetration generally is within this range in all of the soils in the unit. Permeability in the root zone generally is moderate, but it ranges to moderately rapid in the Valois soils. Available water capacity is moderate to low. These soils have moderate amounts of coarse surface fragments that limit erosion slightly, but there is a moderate hazard of erosion because runoff is rapid. Valois and Williamson soils commonly are on complex, short slopes, and the other soils in the unit generally occupy fairly long slopes.

These soils are well suited to crops commonly grown in the county, and they respond well to good management practices. Slope and surface fragments limit the cultivation of row crops. The use of these soils for cultivated crops is limited unless measures are taken to control erosion. Deep-rooted crops are better suited than other crops. Applications of lime are needed if legumes are grown.

Contour tillage, contour stripcropping, and grassed waterways are needed to control erosion and conserve moisture. Keeping tillage to a minimum, growing a cover crop, and properly using crop residue help to maintain soil structure and increase the rate of water intake.

If row crops are grown, planting in surface mulch of plant residue, using no-plow tillage, and keeping tillage to a minimum help to protect the soils.

CAPABILITY UNIT IIIe-3

This unit consists of deep, well-drained, moderately sloping, medium-textured soils. These soils are in the Allard and Arkport series.

Permeability is moderate to rapid in the root zone, which extends to a depth of 24 inches or more. Available water capacity is moderate to high in the Allard soils and moderate to low in the Arkport soils. Natural fertility is low to medium. The content of organic matter in the surface layer generally is low. All the soils in this unit are very erodible. Slopes are short and irregular.

The soils in this unit are well suited to crops commonly grown in the county, but slope limits their use for vegetables. Deep-rooted forage crops grow well if the soils are limed and fertilized.

These soils need measures that help to control soil blowing and water erosion. Growing sod crops in the cropping system, growing crops that provide winter cover, and returning crop residue to the soil help to protect the soil, maintain organic-matter content, and keep infiltration of natural rainfall at a maximum rate. The complex topography limits the use of contour tillage. These soils are well suited to planting selected row crops in plant residue which is maintained on the surface by using no-plow tillage and keeping it to a minimum. If the soils are irrigated, application of water at a moderate rate helps to control erosion and curtail soil loss.

CAPABILITY UNIT IIIe-4

This unit consists of deep and moderately deep, generally moderately well drained, moderately sloping soils. These soils are in the Aurora, Conesus, and Varysburg series. The Varysburg soil is well drained in places. Aurora soils are 20 to 40 inches over shale bedrock. These are medium-lime to low-lime soils.

Root penetration generally is restricted to 20 to 30 inches by a seasonal high water table that is perched on a slowly permeable layer in the subsoil or substratum. Permeability in the root zone ranges from moderate in the Conesus soils to moderately slow or slow in the Aurora soils and moderate to moderately rapid in the Varysburg soils. Available water capacity generally is moderate, but it ranges to high in the Conesus soil and low in the Varysburg soil. Natural fertility is variable. These soils contain coarse fragments that somewhat curb erosion, but runoff is rapid, and slopes generally are long, so the hazard of erosion is moderate to severe.

The soils in this unit are suited to crops commonly grown in the county, but careful management is needed to control erosion and to maintain fertility. Although the content of lime increases with depth, these soils need applications of lime to assure good growth of legumes. Fertilizer is also needed.

Contour tillage, contour stripcropping, and diversions are measures that help to control soil and water loss. Growing crops that provide winter cover and keeping tillage to a minimum for row crops planted in residue on the surface help to maintain tilth and reduce soil and water loss.

CAPABILITY UNIT IIIe-5

This unit consists of deep, generally moderately well drained, moderately sloping soils that formed in glacial till. These soils are in the Langford, Mardin, and Marilla series. Langford soils are well drained in places.

All the soils have a dense, slowly or very slowly permeable fragipan at a depth of 14 to 25 inches, and root penetration generally is restricted to the zone above the pan. Permeability is moderate in the root zone. Available water capacity is moderate to low. Lime needs are high, and natural fertility is medium to low. These soils have moderate amounts of coarse fragments on the surface that help to limit erosion, but they generally are on parts of long slopes where runoff is very rapid, and the hazard of erosion is severe.

The soils in this unit are suitable for corn, small grain, hay, and pasture. Corn that matures early and legumes that can tolerate some wetness need to be grown. Measures that help to prevent soil and water loss are needed for all crops. Slope and surface stones limit the selection of row crops.

Using diversions and contour stripcropping, keeping tillage to a minimum, and returning crop residue to the soil are ways to reduce the hazard of erosion and maintain good soil structure. Diversions are also needed in places to break up long slopes or to divert concentrations of water from adjacent areas. Large applications of lime and annual applications of fertilizer are needed to maintain stands of legumes for more than 1 year. Harvest management practices are also important to the maintenance of stands. A cropping system that maintains crop residue on the surface for as long as possible is needed to protect the surface from sealing over. Increasing the infiltration of natural rainfall is needed in summer. The intensity of cultivation used on these soils depends on the protective conservation measures used.

CAPABILITY UNIT IIIe-6

This unit consists of deep, generally moderately well drained, moderately sloping soils that have a silty surface layer and a stone-free surface. These soils are in the Canaseraga, Collamer, Danley, Nunda, and Williamson series. Canaseraga soils are well drained in places.

The soils of this unit are very erodible. Subsoil conditions vary in these soils. Canaseraga and Williamson soils have dense fragipans, Danley and Nunda soils have a shaly silty clay loam or clay loam subsoil, and Collamer soils have a firm silt subsoil. Permeability is moderate or moderately slow in the root zone, which generally extends to a depth of 20 to 30 inches. Lime needs are variable. Natural fertility generally is medium to low, but potassium reserves are higher in the subsoils of the Danley and Nunda soils than in those of the other soils. Collamer soils generally are on complex short slopes, and the other soils generally are on long, smooth slopes.

The soils in this unit are suited to crops commonly grown in the county, but slope and the severe hazard of erosion limit the use of these soils for cultivation unless protective measures are applied.

If the soils in this unit are mismanaged or permitted to erode, good tilth is difficult to restore and maintain. Conservation practices are needed in areas where row crops are grown. Using diversion terraces, using contour stripcropping, returning crop residue to the soil, growing sod crops, and applying lime and fertilizer according to soil tests are measures that help to assure a favorable growth of field crops. If measures are not taken to control erosion, the maximum intensity of cropping should be no more than 1 year of row crops followed by

a fall-seeded crop of small grain and then 6 years of hay. Because these soils are slowly permeable, a cover of plant residue is needed to maintain the infiltration rate and to control erosion of the surface layer.

CAPABILITY UNIT IIIe-7

Arnot channery silt loam, 2 to 8 percent slopes, is the only soil in this unit. It is a strongly acid to very strongly acid, well drained to moderately well drained soil that is less than 20 inches thick over hard sandstone bedrock. Root penetration is restricted to the moderately permeable to moderately rapidly permeable layers above the bedrock. Available water capacity and natural fertility are low or very low. Occasional rock outcrops or very thin soils interfere with tillage. The hazard of erosion is severe in areas where soils are more sloping.

The soil in this unit is only moderately productive, because the shallow depth reduces the supply of water and nutrients. It responds to applications of lime and fertilizer, but crop growth depends on depth to bedrock and the amount of available water. Crops that mature early are most dependable. Slope and rock outcrops generally restrict the use of these soils and increase the possibility of runoff and erosion. Measures are needed to conserve soil and water, especially on steeper or longer slopes.

If this soil is continuously cultivated, the structure of the surface layer is subject to deterioration. Such intensive use increases soil erosion and loss of water. Measures are needed to keep water and soil loss at a minimum. This soil is cultivated in places in a cropping system that includes 1 year of a row crop to 6 years of a sod crop without using other management practices. If contour tillage or stripcropping are used, this soil can be used more intensively in a rotation of 2 years of a row crop and 2 years of a sod crop.

CAPABILITY UNIT IIIe-8

This unit consists of moderately sloping soils that are mostly somewhat poorly drained. They have a medium-textured surface layer and a clayey subsoil. These soils are in the Caneadea, Churchville, and Hornell series. In places the Caneadea and Hornell soils are moderately well drained. Loamy till is at a depth of 2 to 3½ feet in Churchville soils. Shale bedrock, at a depth of 2 to 3½ feet, is the underlying material of Hornell soils.

Permeability is moderately slow to very slow in the root zone, which generally extends to a depth of 12 to 24 inches. Available water capacity is moderate to low. Reaction and natural fertility are medium to high in the Churchville soils and very low in the Hornell soils. In some areas soils of this unit are eroded and have a surface layer of silty clay loam. In these areas the soils become lumpy if tilled under adverse moisture conditions. Slopes generally are fairly long, but in places length is variable in Caneadea soils. Soils in this unit are erodible.

The soils in this unit are suited to most crops commonly grown in the county if erosion is controlled. They need lime if selected crops are grown. Hornell and Caneadea soils require large applications of lime. The selection of crops and management practices are influenced by the seasonal wetness and high clay content of these soils.

If row crops are grown, they need to be in a cropping system that includes sod crops and crops that provide winter cover to reduce soil loss. Diversion terraces are effective on long slopes. These combined with management that includes stripcropping, keeping tillage to a minimum, and returning crop residue to the soil are effective ways to control wetness and erosion. Plowing, tillage, and wheel traffic need to be restricted on these soils if the soils are wet. Drainage of wet areas facilitates field management. If conservation practices are not used, these soils are better suited to hay and forage crops that tolerate some wetness, such as birdsfoot trefoil and timothy.

CAPABILITY UNIT IIIe-9

This unit consist of deep, somewhat poorly drained, moderately sloping soils that formed in glacial till. These soils are in the Darien, Erie, Fremont, and Volusia series. All but the Darien soils have moderate amounts of channery fragments on the surface.

Permeability is moderately slow or slow in Darien and Fremont soils, which have a subsoil that is high in content of clay. Erie and Volusia soils have a dense, slowly permeable fragipan at a depth of about 10 to 18 inches. This fragipan and seasonal wetness restrict root penetration mainly to the zone above the pan. Available water capacity is moderate to low. Lime needs are medium to low in the Darien soils and high in the other soils. Natural fertility is medium to low, except for the Darien soils, which have higher potassium reserves. Slopes generally are long, and the hazard of erosion is severe.

The soils in this unit are suited to general field crops and pasture, but ample use of lime and fertilizer is needed. Because these soils remain wet and cold until late in spring, only crops that tolerate somewhat poor drainage, such as early corn and legumes, should be planted. These soils are not suited to grazing early in spring. Sod crops benefit from applications of nitrogen fertilizer early in spring by using moisture more efficiently. Surface stones, slope, and wetness in spring influence the selection of crops for planting. A cropping system of 1 year of cultivated row crops, 1 year of small grain, and 2 or 3 years of sod is suitable if these sloping soils are protected from erosion. Soil and water loss can be reduced by using graded stripcropping and grassed waterways and returning crop residue to the soil.

Drainage diversions, if feasible, increase the use of these soils. Spot drainage of wetter soils is also desirable. In places diversions break up long slopes that intercept water concentrations from adjacent areas. Using a crop that provides a winter cover and leaving crop residue on the surface help to protect these soils from erosion and to maintain organic-matter content.

CAPABILITY UNIT IIIw-1

This unit consists of deep and moderately deep, somewhat poorly drained, nearly level soils. These soils are in the Angola, Appleton, Burdett, Darien, Fremont, Homer, Niagara, and Red Hook series. Moderate amounts of coarse fragments are in the surface layer in some areas but are absent in other areas.

Unless these soils are drained, root penetration is mainly restricted to a depth of 15 to 24 inches by a seasonal high water table. Permeability is moderately rapid to slow in the root zone. Available water capacity is mainly moderate but ranges from high to low. Effective drainage increases the depth of root penetration and the available water capacity. Natural fertility is variable. Seasonal wetness and some ponding in places after heavy rain are the main limi-

tations to use. The Angola soils have shale bedrock at a depth of 20 to 40 inches, but this bedrock generally can be broken by tillage machinery.

The soils in this unit are suited to all field crops and most vegetable crops commonly grown in the county if they are effectively drained, limed, and fertilized. Irrigation needs to be carefully controlled to prevent damage caused by sealing of the surface. Undrained areas of these soils are better suited to such forage crops as birdsfoot trefoil and timothy that can tolerate some wetness than to other uses.

In places the Appleton, Homer, and Red Hook soils and some areas of Fremont soils have stones on the surface that interfere with the selection of crops. The other soils are relatively stone free. Removal of excess water is needed if these soils are intensively cultivated. Tile and open-ditch drainage can be used for this purpose, but careful design and installation are needed. In most areas land smoothing is an effective way to obtain surface drainage. Runoff from adjacent areas needs to be diverted. The availability of drainage outlets needs to be determined by on-site inspection. Row crops can be grown continuously if all crop residue is returned to these soils. Keeping tillage to a minimum and using a cropping system that includes an occasional sod or annual green-manure crop help to maintain soil structure. Cultivating fields when they are wet impairs tilth.

CAPABILITY UNIT IIIw-2

This unit consists of deep, somewhat poorly drained, nearly level soils that have a dense, slowly and very slowly permeable fragipan at a depth of about 10 to 18 inches. These soils are in the Dalton, Erie, Volusia, and Wallington series.

In drained or undrained areas, root penetration is restricted to the zone above the pan in contrast to the soils in capability unit IIIw-1 where effective drainage will increase rooting depths. Available water capacity is low to moderate. Extreme wetness and dryness are the major limitations to use of these soils. Lime needs are high. Natural fertility is medium to low. Erosion is not a problem.

Unless the soils in this unit are drained, wetness delays planting in spring and limits the choice of crops. If drainage is not practicable, these soils are suited to forage if they are planted to water-tolerant varieties and fertilized annually, using a complete fertilizer high in nitrogen. Also, water from higher areas needs to be diverted to control the excess water.

Unless an annual cover crop is grown and all plant residue is returned to the soil, these soils should not be plowed more than three years in succession before they are planted to at least one year of sod. Surface depressions need smoothing to supplement drainage systems and to make fields more uniform for efficient crop growth. Tile is suitable for random drainage of wet spots, but a complete drainage project needs to include some pattern of open drainage because of the slow permeability and shallow depth of the fragipan. Careful tilth management is needed for moderately intensive use of these soils. Plowing should be done only when soil moisture is moderate or low. Fall plowing is desirable in places. Returning crop residue to the soil, keeping tillage to a minimum, and disking stubble before plowing are helpful practices.

Stone fragments on the surface of Volusia soils have some effect on crops grown, but the Dalton, Erie, and Wallington soils are relatively stone free on the surface. If these latter soils are irrigated, they crust over rapidly, so water should be applied slowly.

CAPABILITY UNIT IIIw-3

This unit consists of deep and moderately deep, somewhat poorly drained to moderately well drained, nearly level soils. These soils are in the Caneadea and Hornell series. Caneadea soils are in valleys, and in rare instances some areas are subject to flooding. Hornell soils are on uplands and are underlain by shale bedrock at a depth of 20 to 40 inches.

Root penetration is mainly in the upper 12 to 24 inches of these soils. Permeability is slow or very slow in the clayey subsoil. Available water capacity is moderate to low. Prolonged wetness and some ponding are the main limitations to use, and it is difficult to drain these soils. These soils become very lumpy if they are tilled under adverse moisture conditions. Lime needs are high, especially on Hornell soils. Natural fertility is medium to high in the Caneadea soils and very low in the Hornell soils.

Drainage and water management are needed before the soils in this unit are cultivated and used for row crops. If drainage is not practicable, the soils are suited to forage—if they are planted to grasses that are tolerant of a high water table and if they are fertilized annually with a complete fertilizer high in nitrogen. Lime and fertilizer are needed for all crops. Careful management practices are needed if row crops are grown. The soils should not be plowed more than 3 years in succession before they are planted to at least 1 year of sod unless an annual cover crop is grown and all crop residue is returned to the soil. Adequate surface drainage to remove pockets of water generally is needed for crop growth, and runoff from higher areas needs to be diverted to safe outlets.

Because the content of clay is high, careful tilth management is needed for moderately intensive use of these soils. Plowing should be done only when soil moisture is moderate or low. Fall plowing is desirable in places. If irrigation is used on these soils, they crust over rapidly, so the rate of water application should be slow to moderate. Also, traffic needs to be restricted if these soils are wet. Growing a winter cover crop and keeping all the residue on the surface help to maintain organic-matter content and keep surface soils open to natural rainfall.

CAPABILITY UNIT IIIw-4

This unit consists of gently sloping soils in the Caneadea, Churchville, and Hornell series that generally are somewhat poorly drained. In places the Caneadea and Hornell soils are moderately well drained. Churchville soils are underlain by loamy till, and Hornell soils have shale bedrock at a depth of about 20 to 40 inches.

Root penetration generally is at a depth of 12 to 24 inches. Permeability is very slow to moderately slow in the clayey subsoil. Available water capacity is moderate to low. Reaction and natural fertility are medium to high in the Churchville soils and very low in the Hornell soils. Seasonal wetness is a major limitation to the use of these soils. They become very lumpy if they are not tilled under suitable moisture conditions. The hazard of erosion is severe on longer slopes.

The soils in this unit can be used for field crops commonly grown in the county, but careful management is

needed to control drainage and erosion. The Churchville soils are less acid than other soils in this unit, but all the soils need applications of lime and fertilizer for good crop growth. Areas of soils in this unit that are not protected can be used for growing forage that tolerates wetness. A high-nitrogen fertilizer program is needed on sod crops to maintain good growth.

Diversions that break up long slopes, grassed waterways, drainage of wet areas, and more general surface drainage are ways to dispose of water. Using contour tillage, managing plant residue, and keeping tillage to a minimum are used along with water-disposal measures for more effective soil and water management. Because of high clay content, the soils in this unit should not be cultivated or worked if they are wet. They puddle and crust easily. Growing a sod crop and frequently returning plant residue to the soil are helpful.

CAPABILITY UNIT IIIw-5

This unit consists of deep and moderately deep, generally somewhat poorly drained, gently sloping soils. They have a subsoil that is fairly high in content of clay. These soils are in the Angola, Aurora, Appleton, Burdett, Darien, and Fremont series. The Angola and Aurora soils are underlain by rippable shale bedrock at a depth of about 20 to 40 inches. The Aurora soils are moderately well drained.

Unless these soils are drained, root penetration is mainly restricted to the upper 15 to 24 inches by a seasonal high water table. Permeability in the root zone generally is moderate to moderately slow or slow. Available water capacity is moderate to high. Effective drainage increases the depths of rooting and the available water capacity. Natural fertility ranges from high to low, and reaction ranges from very strongly acid to mildly alkaline. These soils generally receive runoff from adjacent soils. Seasonal wetness is the main limitation to the use of these soils, but erosion is also a hazard because slopes generally are long.

The soils in this unit are suited to most field crops commonly grown in the county. If these soils are used for cultivated crops, they need to be adequately limed and fertilized, effectively drained, and protected from erosion. Wetness delays planting early in spring. Nitrogen is released slowly if the soils are cold and wet, so crops respond to early applications of nitrogen. Angola, Appleton, and Aurora soils have surface stones that influence the choice of crops in places, but Burdett, Darien, and Fremont soils are relatively stone free. Row crops can be grown frequently, but all crop residue needs to be returned to the soil. Unless these soils are drained and protected, they are better suited to mixtures of permanent forage crops, such as birdsfoot trefoil and timothy.

Keeping tillage to a minimum and using a cropping system that includes a sod crop and a winter cover crop help to maintain soil structure. Excess water needs to be removed safely to maintain crop growth and control erosion. Using diversions or terraces, waterways, and stripcropping are ways to effectively control soil loss and water disposal if these soils are cultivated. Draining wet soils helps to make field management more efficient. Tile and open surface drains can be used, but they need to be carefully designed and installed. Land smoothing to remove shallow depressions is also an effective supporting measure. Irrigation needs to be carefully controlled to avoid damage and sealing of the soil surface.

CAPABILITY UNIT IIIw-6

This unit consists of deep, somewhat poorly drained, gently sloping soils that have a dense, slowly and very slowly permeable fragipan at a depth of about 10 to 18 inches. These soils are in the Dalton, Erie, and Volusia series.

Even if these soils are drained, root penetration is mainly restricted to the zone above the fragipan in contrast to the soils of capability unit IIIw-5, where effective drainage increases the depth of rooting. Available water capacity is low to moderate. Lime needs are high. Natural fertility is medium to low. Extreme wetness and dryness are major limitations to the use of these soils. Slopes generally are long so there is a hazard of erosion.

The soils in this unit are suited to pasture and to common field crops, such as corn, small grains, and hay. Effective drainage improves the suitability for crops. Applications of lime and fertilizer are needed for good crop growth. These soils remain cold and wet for long periods in spring, and because of this they are not suited to early planting or early grazing. Early maturing corn and grasses and legumes that are tolerant of cold, wet soil are suited if drainage practices are used.

The control of erosion is very critical because of the shallow depth to the fragipan. A cropping system that includes 1 year of a cultivated crop, 1 year of small grain, and 2 years of a sod crop can be used if these soils are drained and protected from erosion. Measures that help to control erosion are planting in graded rows, stripcropping, using diversions, keeping tillage to a minimum, managing crop residue, and using grassed waterways. Response to tile drainage is limited and only small localized wet spots should be drained below the surface. Surface water runoff can be controlled and safely disposed of by using a planned system of diversion terraces that controls erosion and permits more intensive cultivation. If these soils are not drained and if erosion is not controlled, permanent forage crops that are tolerant to wet conditions generally are more suitable than other crops.

Application of nitrogen in spring to soils in sod crops provides good forage later in spring. Soils in this unit are not so well suited to crops as deeper, better drained soils.

CAPABILITY UNIT IVe-1

This unit consists of deep, well-drained to excessively drained, moderately steep soils on glacial outwash and till deposits. These soils are in the Bath, Chenango, Howard, Lansing, Madrid, and Valois series. They have many coarse fragments on the surface.

Roots extend to a depth of about 30 inches or more in places in all but the Bath soils, which have a fragipan at a depth of 18 to 34 inches that restricts rooting. Available water capacity generally is moderate, but it ranges from low to high. Large amounts of water, however, are lost through rapid runoff. Natural fertility is mainly medium to low, but Lansing soils have a higher potassium reserve than the other soils in this unit. These moderately steep soils are very susceptible to erosion. Complex short slopes are common.

The soils in this unit are suited to limited crop growth and pasture. The operation of modern farm equipment is difficult and hazardous because of slope. Difficulty in working these soils and the hazard of erosion make sod crops more practical to grow than other crops. Deep-rooted

legumes are preferred in seeding mixtures. Moderate to large applications of lime are needed for growing legumes, and fertilizer should be topdressed annually as needed to maintain maximum forage growth. Careful harvesting management and good use of fertilizers according to soil tests are needed for legume and grass mixtures that are used for hay or pasture.

If these soils are cultivated, a protective cover needs to be maintained for as long as possible. If row crops are grown, a cropping system that includes no-plow planting and that maintains crop residue on the surface helps to protect these soils. If slope permits, contour tillage or contour stripcropping can also be used.

CAPABILITY UNIT IVe-2

This unit consists of acid soils that are less than 40 inches deep over bedrock. These soils are in the Arnot, Lordstown, and Manlius series. In most areas the soils are well drained, but in places the Arnot soils are moderately well drained, and the Manlius soils are excessively drained. The Arnot soils are less than 20 inches deep over bedrock and are moderately sloping, and the Lordstown and Manlius soils are 20 to 40 inches deep over bedrock and are moderately steep. In places tillage operations are difficult because the soils are very thin or have ledges of bedrock outcrop.

Available water capacity is very low to low in the Arnot soils, and low to moderate in the other soils in this unit. Natural fertility is low to medium. Because these soils generally are on parts of long slopes, the hazard of erosion is severe.

The soils in this unit are better suited to forage mixtures that include deep-rooted plants than to other crops. Stone fragments and slope restrict their use for cultivated crops. Application of lime and fertilizer are needed.

These soils are droughty, and protective cover is needed to control erosion and to increase infiltration of natural rainfall. Renovating and working the soil across the slope to protect it from soil and water loss are important practices in the reseeding of forage crops. Maintaining surface mulches and working across the slope in the contour are suitable practices for either growing row crops or renovating.

CAPABILITY UNIT IVe-3

Arkport very fine sandy loam, 15 to 25 percent slopes, is the only soil in this unit. It is a deep, well-drained, sandy soil.

Natural fertility is moderately low to low. Available water capacity is moderate to low, and much moisture is lost through rapid runoff. Slopes generally are short and irregular. This soil is very erodible.

The soil in this unit is suited to deep-rooted forage mixtures that are used for early grazing. Slope limits the use of high-speed harvesting machinery in places. Row crops can be grown occasionally if the soils are protected from soil blowing and water erosion. These soils leach rapidly, so applications of lime and fertilizer should be based on crop needs as indicated by tests.

If the soil in this unit is included in cultivated fields, a crop that produces good residue or a crop that provides a winter cover should be used. Where slopes permit, row crops can be grown occasionally if no-plow tillage is used. Reseeding by renovation is needed for high-quality hay or pasture.

CAPABILITY UNIT IVe-4

This unit consists of deep, mainly moderately well drained, moderately steep soils on glacial till. These soils are of the Langford and Mardin series. In places Langford soils are well drained.

The soils of this unit, at a depth of about 14 to 24 inches, have a dense fragipan that is slowly or very slowly permeable. Available water capacity is low to moderate. Natural fertility is medium. These soils generally are on parts of long slopes that receive runoff from adjacent upper slopes. The hazard of erosion is serious.

The soils in this unit can be used to a limited extent for crops, but steepness and excessive runoff are limitations. The operation of farm equipment is hazardous because of slope. This hazard, along with stones on the surface, limits crop selection. The restricted root zone results in droughtiness in summer in places. Large applications of lime are needed on these strongly acid to medium acid soils. They are better suited to grass and legume mixtures that tolerate some wetness caused by the fragipan, than to other crops. Ample applications of fertilizer are needed annually to maintain growth. Careful harvest management of forages is also needed.

The soils in this unit can be used for row crops along with adjoining soils if management includes contour tillage, contour stripcropping, use of a winter cover crop, and careful use of residue. All practices that increase infiltration and conserve rainfull in summer are beneficial. These soils cannot be safely used intensively for row crops, because of slope and the serious hazard of erosion.

CAPABILITY UNIT IVe-5

This unit consists of deep, moderately well drained to well drained, moderately steep soils. These soils are in the Collamer, Nunda, and Varysburg series. Root penetration is mainly in the upper 20 to 30 inches. Permeability in the root zone is moderate to moderately slow in the Collamer and Nunda soils and moderate to moderately rapid in the Varysburg soils. The Collamer and Nunda soils are very susceptible to erosion. Available water capacity is moderate to high in the Collamer and Nunda soils and low to moderate in the Varysburg soils. Natural fertility generally is medium, but Nunda soils have a higher potassium reserve in the deep subsoil, and Varysburg soils have low natural fertility in the root zone. Varysburg soils have a moderate content of gravel in the surface layer. Slopes are moderate in length and are somewhat irregular in the Collamer and Varysburg soils.

The soils in this unit are better suited to permanent cover for hay or pasture than to other uses. Slope severely limits the use of heavy or high-speed machinery for planting or harvesting. Applications of lime in varying amounts are needed for establishment of legumes. Applications of fertilizer are also needed for best crop response.

If these soils are cultivated, good surface tilth is difficult to maintain without the use of a sod crop and crop residue to help control erosion. In places where slopes are not complex, stripcropping can be used if the soils are included in a field made up generally of less sloping soils. Topdressing with fertilizer and keeping the surface covered with crop residue in winter help to maintain productivity of hay stands. Cleared areas of these soils can be converted to rotation pasture and managed to maintain productive stands.

CAPABILITY UNIT IVw-1

This unit consists only of soils of the Tuller series. These are shallow, poorly drained or somewhat poorly drained, strongly acid to very strongly acid soils that are nearly level or gently sloping. They are about 10 to 20 inches deep over sandstone bedrock, which causes extremes of wetness and dryness. These characteristics are among the major limitations to their use. These soils are extremely difficult to drain because of the shallow depth to bedrock. Available water capacity is low to very low. Natural fertility is low to medium.

The soils in this unit are best suited to pasture or natural woodland. Shallowness to bedrock, rock outcrops, and extremes of wetness and dryness make the soils impractical to cultivate, except for renovation of hay or pasture. Cleared areas can be improved in places if surface drainage is used during the dry season to remove excess water so that good grass sods can be established or forage crops grown. Liberal applications of lime and fertilizer are needed. Applications of nitrogen on grass in spring provide good growth of pastures late in spring and summer. The soils in this unit are not suited to early grazing. Grasses that are tolerant of wet, cold soils are better suited than other plants.

CAPABILITY UNIT IVw-2

This unit consists of deep, poorly drained and very poorly drained, nearly level soils. These soils are in the Ellery, Halsey, Ilion, Lyons, and Sun series. Unless they are drained, root penetration is mainly in the upper 6 to 15 inches of these soils because of the prolonged high water table. Effective drainage increases the rooting depths in all but the Ellery soils, which have a dense fragipan at a depth of about 10 to 18 inches.

Permeability in the subsoil is slow in the Ellery and Ilion soils, moderate in the Lyons and Sun soils, and moderate to moderately rapid in the Halsey soils. Available water capacity ranges from low in the Ellery soils to high in the Sun soils, but lack of moisture is seldom a problem. Excessive wetness is the major limitation to use of these soils. Natural fertility is mainly medium to high but ranges to low in the Sun soils.

Although these soils are naturally too wet for cultivation, they generally can be drained. Where outlets are available, response to tile drainage generally is good in the Halsey, Lyons, and Sun soils, and is less effective or ineffective in the Ellery and Ilion soils. Open ditches, surface drainage, land shaping, or some combination of these with tile to remove water held in pockets is needed. If tile is installed, special care is needed in places to prevent plugging with silt and fine sand. If they are adequately drained, these soils are suited to most crops grown in the county. Continuous row cropping is used in places. Growing a cover crop, keeping tillage to a minimum, and returning all possible crop residue to the soil are ways that help to maintain the organic-matter content in a friable surface soil.

It is important to keep all excess surface water from draining onto these soils by diverting the runoff from adjacent areas via a water-disposal system. The use of undrained areas generally is limited to pasture, but in dry years they can be used for short-season crops. Annual applications, according to soil tests, of a complete fertilizer in areas of grass sods that are tolerant of wetness and ponding result in good forage production. Plowing, preparation of seedbeds, and seeding need to be done during the dry periods of summer when prolonged wetness is less likely to occur. High-value crops on these soils need supplemental irrigation in places for maximum returns.

CAPABILITY UNIT IVw-3

Canadice silty clay loam is the only soil in this unit. It is a poorly drained, nearly level, medium-lime soil that formed in silty clay.

Permeability of the subsoil is very slow. This soil becomes very cloddy if worked under adverse moisture conditions. An adequate drainage system is difficult to install because most of this soil is on flood plains that are occasionally flooded.

Unless this soil is drained, prolonged wetness keeps it from being cultivated. If drainage is provided, the soil responds to management and is suited to cultivated crops and forage crops. Areas plowed during the dry part of summer and shaped so that surface water drains off readily are suited to grass and legume mixtures, such as birdsfoot trefoil and grass. The root zone is comparatively shallow. Surface drainage depends upon available and satisfactory outlets. Areas that are naturally seeded to suitable grasses can be topdressed, using a complete fertilizer, and grazed during the summer when other areas are dry.

CAPABILITY UNIT IVw-4

This unit consists of poorly drained and very poorly drained, nearly level soils on flood plains. These soils are in the Papakating and Wayland series.

Wayland soils are nearly neutral, and Papakating soils are medium acid to slightly acid in reaction. Unless these soils are drained, root penetration is mainly in the upper 10 inches. A good drainage system is difficult to install because of lack of sufficient outlets. Susceptibility of soils to flooding is a severe limitation to crop growth.

The soils in this group are better suited to pasture if plants tolerant to wet, cold conditions are grown. These soils are suited to row crops only if they are drained and protected from flooding. Annual forage crops and permanent sod crops that tolerate wet conditions are most dependable. Lime needs vary, although lime content decreases with depth. Mid-season and late crops tolerant to wet conditions grow well, but only if these soils can be drained and the hazard of flooding minimized. Cultivated crops can be grown frequently in the cropping system if the soil is carefully managed to maintain surface tilth.

Outlet ditches and occasional tile in depressions are needed to improve these soils after the hazard of flooding has been removed. Shallow pockets on the surface also need to be drained to make the field more uniform for efficient use. To avoid surface compaction, these soils should not be cultivated when wet. Growing an occasional sod crop, returning crop residue to the soil, and keeping tillage to a minimum help to maintain good tilth. Irrigation generally is not suitable because of the moderate rate of intake of these soils and prolonged wetness after rains. Surface-drained fields are suited to forage crops that tolerate periods of flooding. In places trampling from early pasturing damages the sod. Forage growth can be maintained by annual use of fertilizer.

CAPABILITY UNIT IVw-5

This unit consists of very poorly drained soils that are saturated most of the year. These soils are in the Alden, Papakating, and Wallkill series.

The Alden and Papakating soils in this unit have a mucky surface layer. The thin Wallkill soils formed in alluvium over muck.

Natural fertility is medium to high. An adequate drainage system generally is very difficult to install, and frequent flooding, or in the case of Alden soils, ponding, limits the use of these soils.

If the soils in this unit are artificially drained and protected from flooding or ponding, they can be used for cultivated crops. They are not difficult to keep in good tilth, and they respond to tile drainage where outlets are available. If they are drained, nearly continuous row cropping can be practiced in places. Growing a cover crop, returning crop residue to the soil, and keeping tillage to a minimum are needed practices. Undrained areas are not suited to highly managed pastures. Native hardwood generally grows in these areas.

CAPABILITY UNIT VIe-1

This unit consists of deep, well-drained to somewhat excessively drained, steep soils on medium-textured glacial till and gravelly glacial outwash. These soils are in the Bath, Chenango, Howard, and Lansing series. Reaction of these soils ranges from very strongly acid to medium acid. Available water capacity ranges from high in the Lansing soils to low in the Chenango soils, but soils with a more favorable water capacity lack moisture in many places because of very rapid runoff. These steep soils are very erodible if the cover is removed. The content of surface stones in these soils is moderate.

The soils in this unit are not suited to cultivation because of steepness and the excessive hazard of erosion. They are better suited to areas of permanent sod, which can be managed as pasture or used for woodland. On slopes where pasture management practices are used, deep-rooted legumes are well suited. Applications of lime and fertilizer are needed to maintain stands and assure good growth. Renovation should be used for reseeding. Topdressing the soil with a complete fertilizer helps to maintain growth for many years in those areas where this is practicable.

CAPABILITY UNIT VIe-2

This unit consists of steep, well-drained to excessively drained acid soils that are about 20 to 40 inches deep over bedrock. These soils are in the Lordstown and Manlius series and generally are on parts of very long slopes. Rock outcrops are common.

Runoff is very rapid and the hazard of erosion is severe. These soils are droughty in places because of the high rate of runoff. Many areas of these soils have numerous small gullies.

The soils in this unit are too steep for safe use of farm machinery. Open areas are suitable for pasture, but cover vegetation needs to be maintained and grazing controlled to protect the soils from damage by erosion.

CAPABILITY UNIT VIe-3

This unit consists of moderately well drained to somewhat poorly drained, moderately steep soils that are severely eroded. These soils are in the Caneadea (fig. 12), Danley, Fremont, and Hornell series. Texture is moderately fine to fine throughout. The Hornell soils are underlain by shale bedrock at a depth of 20 to 40 inches.

Figure 12.—Prismatic structure in an exposed area of a Caneadea soil, capability unit VIe-3

Runoff is rapid, and these soils are very susceptible to continual erosion. The content of organic matter has been depleted as a result of past erosion. Available water capacity is high to low, but even those soils with a more favorable water capacity lack moisture because of runoff. Slopes of the Caneadea soils are irregular while the remaining soils tend to slope in one direction.

These soils are suited to permanent pasture. Reseeding should be done by renovation, and the surface layer should be protected by using all plant residue. Open areas that have satisfactory sods can be topdressed with a complete fertilizer. This improves growth. Grazed areas, however, should be managed to maintain a good cover that will prevent further erosion and deterioration of these steep, eroded soils.

CAPABILITY UNIT VIe-4

The only soil in this unit is Arkport very fine sandy loam, 25 to 40 percent slopes. It is a sandy, stone-free soil that is very susceptible to erosion.

Natural fertility is low. Available water capacity is medium to low, but much water is lost through rapid runoff, so this soil is droughty.

The soil in this unit is too steep for safe use of farm machinery. Open areas are suitable for pasture, and areas of less sloping soil can be renovated and seeded to adapted deep-rooted legumes. Applications of lime and fertilizer and grazing management practices to maintain stands of protective cover are needed. Although the soil can be grazed early in spring, droughtiness in summer limits maximum growth of plants.

CAPABILITY UNIT VIIe-1

This unit consists of moderately well drained and somewhat poorly drained, steep soils that are severely eroded. They are in the Caneadea, Danley, Fremont, and Hornell series. With the exception of the Fremont soils, these soils are moderately fine textured to fine textured throughout.

Runoff is rapid, and the soils are very susceptible to continual erosion. Gullies are common. The content of organic matter has been depleted as a result of past erosion, and these soils are less fertile than uneroded similar soils.

The soils in this unit should be left in natural cover and plant residue maintained on the surface to prevent further erosion. They are too steep to renovate safely, although open areas that have sod can be used for controlled grazing. A protective cover is needed throughout the year. Plant growth can be increased slightly by topdressing the soil with a complete fertilizer. It is best to allow these steep, eroded soils to return to natural vegetation and to protect them from excess grazing.

CAPABILITY UNIT VIIe-2

This unit consists of well-drained to excessively drained, very steep, acid soils that generally are 20 to 40 inches deep over bedrock. These soils are in the Lordstown and Manlius series and generally are along valley walls.

Runoff is very rapid. The hazard of erosion is very severe, and these soils are very droughty.

The soils in this unit are not suited to crops that are harvested by use of machine or livestock. They need to be protected from grazing. A protective cover of plant residue is needed at all times to reduce soil and water loss as much as possible.

Estimated Yields [2]

Table 1 lists, for each soil in the county, the estimated yields per acre of corn, oats, forage mixtures, and grass meadow, under two levels of management. The annually revised editions of "Cornell Recommends for Field Crops" and "Cornell Recommends for Vegetable Crops" can be used as a guide in improving management.

The figures in columns A represent the expected yields under average management. Under this level of management, the application of soil, water, and crop management practices is less than the amount suggested in "Cornell Recommends." Lime applications maintain a pH of 6.0 or less. Fertilizer is seldom applied in areas of sod crops and does not meet crop needs. Only spot drainage is used. Summer rainfall commonly is wasted because erosion-control practices are lacking; cropping systems are haphazard; and the better suited crop varieties are used only occasionally. Field operations commonly cannot be performed on time. The control of weeds, insects, and diseases of plants are not consistently carried out. The estimates shown in columns A are a little above the average yields obtained by farmers in the county in the late 1960's.

The figures in columns B represent yields that can be expected under improved management. Under this level of management a suitable conservation cropping system is used; lime and fertilizer are applied in kinds and amounts indicated by soil tests; adequate drainage and irrigation are provided if needed; contour farming, stripcropping, sodded waterways, or other measures to conserve soil and water are used; weeds and insects are controlled; and tillage is done at the right time and in the right way. Yields are increasing at the rate of about 2 percent each year and can be expected to increase further as new varieties of crops are developed and management is improved.

Use of the Soils as Woodland [3]

Commercial woodlands occupy 30 percent, or 116,300 acres, of Wyoming County. The wooded areas are well distributed throughout the county and cover from 11 percent in the town of Warsaw to 35 percent in the town of Genessee Falls. In the town of Castile are 3,109 acres of State parks (*3*).[4]

Much of Wyoming County is in the southwestern sugar maple subregion. A close pattern of alternating fields and woodlots marks the countryside. Northern hardwoods, including the type of maple that frequently makes up good sugar maple groves, are on medium to good sites. Oak grows on southern slopes where sites are medium to poor (*5*).

Plantations, both small privately owned and larger public developments, make up an important part of the acreage in the county (*5*). Many of the plantations are used for Christmas trees.

On many farms the woods cover sloping, insufficiently drained, or otherwise nontillable soils. Income derived from the sale of timber is a minor contribution to the farm economy.

The areas of commercial woodland-type groups in the county are white pine-red pine, 2,700 acres; other soft woods, including plantations, 6,800 acres; oak, 6,600 acres; elm-ash-red maple, 46,100 acres; maple-beech-birch, 48,100 acres; and aspen-birch, 6,000 acres.[5]

Woodland suitability groups

The soils of Wyoming County have been placed in 19 woodland suitability groups. The woodland groups and the suitability of the soils in these groups for woodland are described in table 2.

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[2] Prepared by E. L. McPherron, *agronomist*; Kermit Kruse, district conservationist; John P. Wulforst, soil scientist, Soil Conservation Service; and John L. Fendick, cooperative extension agent.

[3] By Meredith A. Peters, woodland conservationist, Soil Conservation Service.

[4] Italic numbers in parentheses refer to Literature Cited, p. 197.

[5] Preliminary Forest Survey Statistics, New York, 1967.

Each group is made up of soils that are similar in potential productivity, are suited to similar species of trees, and require similar management. The names of the soils in each group can be readily learned by referring to the "Guide to Mapping Units." All mapping units except for the miscellaneous land types Alluvial land and Rock outcrop have been placed in a woodland suitability group. These land types generally are not suitable for commercial production of trees.

The slope ranges used in determining woodland suitability groups are 0 to 8 percent, 8 to 15 percent, 15 to 35 percent, and 35 percent or more. In this survey other slope ranges were also used, however, and appropriate interpolations were made.

In addition to a brief description of the soils in the group, table 4 gives an indicator species for each group, and the site index for that species is shown. Site index is a numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age. For example, in this survey site index is the average height attained by dominant and codominant trees in a fully stocked stand at 50 years.

Under management problems for each group, ratings are given for erosion hazard, equipment limitations, seedling mortality, plant competition, and windthrow hazard. The ratings are *slight*, *moderate*, or *severe*, according to the degree of the limitation. Also given in the table is species suitability for the soils of each group, both for planting and for those species to favor in natural stands. For those species to favor for planting, high local incidence of weevil or blister rust infestation may dictate use of another species. Information on this can be obtained from the New York State Department of Environmental Conservation.

Each woodland suitability group is identified by a three-part symbol, such as 2o1, 3w5, or 4d1.

The first part of the symbol indicates the class. The class shows the potential productivity based on the site index of the indicator tree species. In this county, it is expressed in arabic numerals ranging from 2 through 5. Soils in class 2 have the highest potential productivity in Wyoming County.

The second part of the symbol indicates the subclass that expresses the dominant soil feature that causes management concern. Some soils within groups have more than one kind of subclass characteristic. Priority in placing each kind of soil into a subclass is in the order that the following subclass characteristics are listed:

Subclass w (excessive wetness).—Soils in which excessive water, seasonally or year round, causes significant limitations for woodland use or management.

Subclass d (restricted rooting depth).—Soils that have restrictions or limitations for woodland use or management because of restricted rooting depths. Soils that are shallow to hard bedrock that restricts the growth of roots are examples.

Subclass r (relief or slope).—Soils that have restrictions or limitations for woodland use or management because of slope.

Subclass o (slight or no limitations).—Soils that have no significant restrictions or limitations for woodland use or management.

The third part of the symbol differentiates woodland suitability groups that have identical first and second parts in their identifying symbol. Soils in woodland group 2o1, for example, require somewhat different management than soils in group 2o2. The management problems considered are erosion hazard, equipment limitations, seedling mortality, plant competition, and windthrow hazard. The ratings are *slight*, *moderate*, or *severe*, according to the degree of the limitation.

Erosion hazard is rated according to the risk of erosion that occurs following cutting operations where the soil is exposed along roads, skid trails, fire lanes, and log-decking areas.

Equipment limitations refer to the trafficability of the soils in the group. Ratings are recorded indicating the degree to which soils restrict or prohibit the use of equipment commonly used in tree harvesting.

Seedling mortality refers to the expected degree of failure for natural seedlings or planting stock as influenced by kinds of soil, degree of erosion, or other site factors. The rating is *slight* if the expected mortality is less than 25 percent, *moderate* if expected mortality is between 25 to 50 percent, and *severe* if it is over 50 percent.

Plant competition refers to the invasion or growth of undesirable species when openings are made in the tree canopy. The rating is *slight* when competition does not delay natural or artificial regeneration of desirable species, *moderate* when competition delays but does not prevent natural or artificial regeneration, and *severe* when competition prevents adequate natural or artificial regeneration without intensive site preparation and maintenance, such as weeding.

Windthrow hazard is an evaluation of the soil characteristics that control root development and affect the firmness of a tree during wind. The rating is *slight* if trees are not expected to be blown down in wooded areas by commonly occurring winds. It is *moderate* if root development is adequate for stability except during periods of soil wetness or during periods of strong wind velocities. It is *severe* if many trees are expected to be blown over because their roots do not provide enough stability.

Species to favor in existing stands is a listing of the species that commonly would be managed for woodland crops. This listing is not intended to be in order of preference.

Species for planting is a listing of species suitable for open-field and woodland interplanting (*4*). Among the species listed, Scotch pine, balsam fir, and Douglas-fir are suited to Christmas trees.

Wildlife[6]

Wildlife is a valuable natural resource in Wyoming County. Populations of white-tailed deer, ruffed grouse, wild turkey, gray squirrels, cottontail rabbits, and ring-necked pheasants are in the county. Game species of songbirds are also an important wildlife resource.

The kind and amount of wildlife that live in a given area are closely related to land use; to the kinds, amounts, and patterns of vegetation; and to the supply and distribution of water. These considerations generally are related to the type of soil.

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[6] By ROBERT E. MYERS, wildlife biologist, Soil Conservation Service.

TABLE 1.—*Estimated average acre yields of*

[Yields in columns A can be expected under ordinary management; those in columns B can be expected under improved

Soil	Corn				Oats	
	For silage		For grain			
	A	B	A	B	A	B
	Tons	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Alden mucky silt loam						
Allard silt loam, 0 to 3 percent slopes	18	23	90	115	70	85
Allard silt loam, 3 to 8 percent slopes	17	21	85	105	70	85
Allard silt loam, 8 to 15 percent slopes	13	18	65	90	50	65
Alluvial land						
Angola shaly silt loam, 0 to 3 percent slopes	11	20	55	100	45	60
Angola and Aurora shaly silt loams, 3 to 8 percent slopes	12	17	60	85	50	65
Appleton gravelly silt loam, 0 to 3 percent slopes	11	20	55	100	45	60
Appleton gravelly silt loam, 3 to 8 percent slopes	12	17	60	85	50	65
Arkport very fine sandy loam, 2 to 8 percent slopes	17	21	85	105	70	90
Arkport very fine sandy loam, 8 to 15 percent slopes	11	15	55	75	40	55
Arkport very fine sandy loam, 15 to 25 percent slopes					35	50
Arkport very fine sandy loam, 25 to 40 percent slopes						
Arnot channery silt loam, 2 to 8 percent slopes	11	15	55	75	40	55
Arnot channery silt loam, 8 to 15 percent slopes					40	50
Aurora shaly silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Bath channery silt loam, 0 to 3 percent slopes	18	22	90	110	70	85
Bath channery silt loam, 3 to 8 percent slopes	16	20	80	100	70	85
Bath channery silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Bath channery silt loam, 15 to 25 percent slopes					45	55
Bath channery silt loam, 25 to 40 percent slopes						
Bath-Valois gravelly loams, 0 to 3 percent slopes	18	22	90	110	70	90
Bath-Valois gravelly loams, 3 to 8 percent slopes	16	20	80	100	70	90
Bath-Valois gravelly loams, 8 to 15 percent slopes	13	17	65	85	50	65
Bath-Valois gravelly loams, 15 to 25 percent slopes	10	15	50	75	45	55
Burdett silt loam, 0 to 3 percent slopes	11	20	55	100	45	60
Burdett silt loam, 3 to 8 percent slopes	12	17	60	85	50	65
Canadice silty clay loam						65
Canaseraga silt loam, 0 to 3 percent slopes	16	20	80	100	70	80
Canaseraga silt loam, 3 to 8 percent slopes	14	18	70	90	70	80
Canaseraga silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Caneadea silt loam, 0 to 3 percent slopes		14		70	45	60
Caneadea silt loam, 3 to 8 percent slopes		14		70	50	65
Caneadea silt loam, 8 to 15 percent slopes		13		65	45	60
Caneadea silty clay loam, 15 to 25 percent slopes, eroded						
Caneadea silty clay loam, 25 to 50 percent slopes, eroded						
Castile gravelly loam, 0 to 3 percent slopes	18	23	90	115	70	90
Castile gravelly loam, 3 to 8 percent slopes	16	20	80	100	70	90
Castile channery silt loam, fans, 0 to 3 percent slopes	18	23	90	115	70	90
Chenango gravelly loam, 0 to 3 percent slopes	18	22	90	110	65	85
Chenango gravelly loam, 3 to 8 percent slopes	16	20	80	100	55	75
Chenango gravelly loam, 8 to 15 percent slopes	13	17	65	85	45	65
Chenango gravelly loam, 15 to 25 percent slopes					45	55
Chenango channery silt loam, fans, 3 to 8 percent slopes	16	20	80	100	55	75
Churchville silt loam, 2 to 8 percent slopes		14		70	50	65
Churchville silt loam, 8 to 15 percent slopes		13		65	45	60
Collamer silt loam, 3 to 8 percent slopes	14	18	70	90	70	90
Collamer silt loam, 8 to 15 percent slopes	11	17	55	85	50	65
Collamer silt loam, 15 to 25 percent slopes					45	50
Conesus gravelly silt loam, 0 to 3 percent slopes	18	23	90	115	70	90
Conesus gravelly silt loam, 3 to 8 percent slopes	16	20	80	100	70	90
Conesus gravelly silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Dalton silt loam, 0 to 3 percent slopes	12	17	60	85	45	60
Dalton silt loam, 3 to 8 percent slopes	12	17	60	85	50	65
Danley silt loam, 3 to 8 percent slopes	14	18	70	90	70	90
Danley silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Danley silty clay loam, 15 to 25 percent slopes, eroded						
Danley silty clay loam, 25 to 40 percent slopes, eroded						
Darien silt loam, 0 to 3 percent slopes	10	18	50	90	45	60
Darien silt loam, 3 to 8 percent slopes	12	17	60	85	50	65
Darien silt loam, 8 to 15 percent slopes		15		75	45	60
Ellery silt loam		20		100		
Erie silt loam, 0 to 3 percent slopes	12	17	60	85	45	60
Erie channery silt loam, 3 to 8 percent slopes	12	17	60	85	50	65
Erie channery silt loam, 8 to 15 percent slopes		15		75	45	60
Fremont silt loam, 0 to 3 percent slopes	10	18	50	90	45	60

principal crops under two levels of management

management. Absence of a yield figure indicates that the crop is not suited to the soil or is not commonly grown]

Wheat		Dry beans		Potatoes		Hay					
						Alfalfa		Alfalfa-trefoil-grass		Trefoil-grass	
A	B	A	B	A	B	A	B	A	B	A	B
Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
50	60	25	35	400	600	4.5	6.0	4.0	5.0	3.0	3.5
50	60	25	35	300	600	4.5	6.0	4.0	5.0	3.0	3.5
35	45					3.5	5.0	3.0	4.0	2.5	3.5
35	50							2.0	3.0	2.0	3.0
40	50		35					2.0	3.0	2.0	3.0
35	50							2.0	3.0	2.0	3.0
40	50		35					2.0	3.0	2.0	3.0
50	60	20	30	275	400	4.5	6.0	4.0	5.0	3.0	3.5
40	45					3.5	5.0	3.0	4.0	2.5	3.0
30	40					2.5	3.5	2.5	3.5	2.0	2.5
30	35					2.0	2.5	1.5	2.0	1.0	2.0
30	35					1.5	2.5	1.0	2.0	1.0	2.0
35	40					3.5	5.0	3.0	4.5	2.5	3.0
50	60	25	35	400	600	4.5	6.0	4.0	5.0	3.0	3.5
50	60	25	35	325	500	4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
30	40					3.5	5.0	3.0	4.0	2.0	3.0
											2.0
50	60	25	35	400	600	4.5	6.0	4.0	5.0	3.0	3.5
50	60	25	35	325	500	4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
30	40					3.5	5.0	3.0	4.0	2.0	3.0
35	50							2.0	3.0	2.0	3.0
40	50							2.0	3.5	2.0	3.5
								2.0	3.0	2.0	3.0
40	50	20	35	300	500	2.5	4.5	3.0	5.0	3.0	4.0
50	60	25	35	275	400	4.5	6.0	4.0	5.0	3.0	4.0
40	45					3.0	4.5	3.0	4.5	2.5	3.5
		20	30				3.0	2.0	3.0	2.0	3.0
40	50	20	30				3.0	2.0	3.0	2.0	3.0
	30						3.0	2.0	3.0	2.0	3.0
40	50	25	35	400	600	3.0	4.5	3.0	5.0	3.0	4.0
50	60	25	35	325	550	3.0	5.5	3.0	5.0	3.0	4.0
40	50	20	35	400	600	3.0	5.5	3.0	5.0	3.0	4.0
50	60	25	35	400	600	5.0	6.0	4.0	5.0	3.0	3.5
50	60	25	35	325	500	4.5	6.0	3.5	5.0	3.0	3.5
40	45					4.5	6.0	3.5	5.0	3.0	3.5
30	40					4.0	5.5	3.0	4.5	2.5	3.5
50	60	25	35	350	500	3.0	5.5	3.0	5.0	3.0	4.0
40	50							2.0	3.0	2.0	3.0
	30						2.5	2.0	3.0	2.0	3.0
50	60	25	35			5.0	6.0	4.5	5.0	3.0	3.5
40	45					3.5	5.0	3.0	4.5	2.5	3.5
30	40					3.0	4.5	2.5	4.0	2.0	3.0
40	50	20	35			3.0	4.5	3.0	5.0	3.0	4.0
50	60	25	35			4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
35	50						3.0	2.0	3.0	2.0	3.0
40	50						3.0	2.0	3.0	2.0	3.0
50	60	25	35			4.5	6.0	4.0	5.0	3.0	3.5
35	40					3.5	5.0	3.0	4.5	3.0	3.5
								2.0	3.5	2.0	3.0
35	50						3.0	2.0	3.5	2.0	3.0
40	50						3.0	2.0	3.5	2.0	3.0
	30						3.0	2.0	3.5	2.0	3.0
											2.5
35	50	20	30			2.0	3.0	2.0	3.0	1.5	3.0
40	50	20	30			2.0	3.0	2.0	3.0	1.5	3.0
	30					2.0	3.0	2.0	3.0	1.5	3.0
35	50			350	450		3.0	2.0	3.0	1.5	3.0

TABLE 1.—*Estimated average acre yields of*

Soil	Corn For silage A	Corn For silage B	Corn For grain A	Corn For grain B	Oats A	Oats B
	Tons	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Fremont silt loam, 3 to 8 percent slopes	12	17	60	85	50	65
Fremont channery silt loam, 8 to 15 percent slopes		15		75	45	60
Fremont and Hornell soils, 15 to 25 percent slopes						
Fremont and Hornell soils, 25 to 40 percent slopes						
Halsey loam		19		95		70
Hamlin silt loam	20	25	100	125	70	90
Herkimer shaly silt loam, 0 to 3 percent slopes	20	25	100	125	70	90
Herkimer shaly silt loam, 3 to 8 percent slopes	20	25	100	125	70	90
Homer gravelly loam	11	20	55	100	45	60
Homer gravelly loam, clayey substratum	11	20	55	100	45	60
Hornell silt loam, 0 to 3 percent slopes		15		75	45	60
Hornell silt loam, 3 to 8 percent slopes		15		75	50	65
Hornel silt loam, 8 to 15 percent slopes		13		65	45	60
Howarld gravelly loam, 0 to 3 percent slopes	18	22	90	110	65	85
Howard gravelly loam, 3 to 8 percent slopes	16	20	80	100	55	75
Howard gravelly loam, 8 to 15 percent slopes	13	17	65	85	45	60
Howard gravelly loam, 15 to 25 percent slopes					45	55
Howard shaly silt loam, 0 to 3 percent slopes	18	22	90	110	65	85
Howard shaly silt loam, 3 to 8 percent slopes	16	20	80	100	55	75
Howard shaly silt loam, 8 to 15 percent slopes	13	17	65	85	45	60
Howard-Madrid gravelly loams, 3 to 8 percent slopes	16	20	80	100	55	75
Howard-Madrid gravelly loams, 8 to 15 percent slopes	13	17	65	85	45	60
Howard-Madrid gravelly loams, 15 to 25 percent slopes	10	15	50	75	45	55
Howard-Madrid shaly silt loams, 3 to 8 percent slopes	16	20	80	100	55	75
Howard-Madrid shaly silt loams, 8 to 15 percent slopes	13	17	65	85	45	60
Howard-Madrid shaly silt loams, 15 to 25 percent slopes					45	55
Howard and Chenango soils, 25 to 40 percent slopes						
Ilion silt loam		20		100		70
Langford channery silt loam, 0 to 3 percent slopes	16	20	80	100	70	90
Langford channery silt loam, 3 to 8 percent slopes	16	20	80	100	70	85
Langford channery silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Langford channery silt loam, 15 to 25 percent slopes					45	50
Lansing gravelly silt loam, 2 to 8 percent slopes	16	20	80	100	70	90
Lansing gravelly silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Lansing gravelly silt loam, 15 to 25 percent slopes	10	15	50	75	45	50
Lansing gravelly silt loam, 25 to 40 percent slopes						
Lordstown channery silt loam, 2 to 8 percent slopes	14	18	70	90	70	85
Lordstown channery silt loam, 8 to 15 percent slopes	13	17	65	85	45	60
Lordstown channery silt loam, 15 to 25 percent slopes					40	50
Lordstown channery silt loam, 25 to 40 percent slopes						
Lyons silt loam		20		100		70
Madrid fine sandy loam, 2 to 8 percent slopes	16	20	80	100	70	90
Madrid fine sandy loam, 8 to 15 percent slopes	13	17	65	85	50	65
Madrid loam, 2 to 8 percent slopes	16	20	80	100	70	90
Madrid loam, 8 to 15 percent slopes	13	17	65	85	50	65
Manlius shaly silt loam, 2 to 8 percent slopes	14	18	70	90	70	85
Manlius shaly silt loam, 8 to 15 percent slopes	13	17	65	85	45	60
Manlius shaly silt loam, 15 to 25 percent slopes					45	50
Manlius shaly silt loam, 25 to 40 percent slopes						
Manlius and Lordstown soils, 40 to 90 percent slopes						
Mardin channery silt loam, 0 to 3 percent slope	16	20	80	100	70	85
Mardin channery silt loam, 3 to 8 percent slopes	16	20	80	100	70	85
Mardin channery silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Mardin channery silt loam, 15 to 25 percent slopes					45	50
Marilla shaly silt loam, 2 to 8 percent slopes	16	20	80	100	70	85
Marilla shaly silt loam, 8 to 15 percent slopes	13	17	65	85	45	60
Niagara silt loam	11	20	55	100	45	60
Nunda silt loam, 2 to 8 percent slopes	14	18	70	90	70	90
Nunda silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Nunda silt loam, 15 to 25 percent slopes					45	50
Palms muck						
Palmyra gravelly loam, 0 to 3 percent slopes	18	22	90	110	65	85
Palmyra gravelly loam, 3 to 8 percent slopes	16	20	80	100	55	75
Papakating silt loam		20		100		65
Papakating mucky silt loam						
Phelps gravelly loam, 0 to 3 percent slopes	18	23	90	115	70	90
Phelps gravelly loam, 3 to 8 percent slopes	16	20	80	100	70	90

principal crops under two levels of management—Continued

Wheat		Dry beans		Potatoes		Hay					
						Alfalfa		Alfalfa-trefoil-grass		Trefoil-grass	
A	B	A	B	A	B	A	B	A	B	A	B
Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
45	50			325	400		3.0	2.0	3.0	1.5	3.0
	30						3.0	2.0	3.0	1.5	3.0
	40						3.0	2.0	3.0	2.0	3.0
50	60	30	35			4.5	6.0	4.0	5.0	3.0	4.0
50	60	30	35			4.5	6.0	4.0	5.0	3.0	4.0
50	60	35	35			4.5	6.0	4.0	5.0	3.0	4.0
		20	30				3.0	2.0	3.0	1.5	3.0
		20	30				3.0	2.0	3.0	1.5	3.0
							3.0	2.0	3.0	1.5	3.0
40	50	20	30				3.0	2.0	3.0	1.5	3.0
	30						3.0	2.0	3.0	1.5	3.0
50	60	25	35	400	600	4.5	6.0	4.0	5.0	3.0	3.5
50	60	25	35	325	500	4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
30	40					4.0	5.0	3.5	4.0	2.5	3.0
50	60	25	35			4.5	6.0	4.0	5.0	3.0	3.5
50	60	25	35			4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
50	60	25	35	350	500	4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
30	40					4.0	5.0	3.5	4.0	2.5	3.0
50	60	25	35			4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
30	40					4.0	5.0	3.5	4.0	2.5	3.0
								2.0	3.0	2.0	3.0
40	50	20	30	350	450	2.5	4.5	3.0	5.0	3.0	4.0
50	60	20	30	300	400	3.0	4.5	3.0	5.0	3.0	3.5
40	45					3.0	4.5	3.0	4.5	3.0	3.5
30	40					2.5	4.0	2.5	4.0	2.5	3.0
50	60	20	35			4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.5	6.0	4.0	5.0	3.0	3.5
30	40					3.5	5.0	3.0	4.0	2.5	3.0
50	60	20	30	350	450	3.0	5.0	3.0	4.5	3.0	3.5
35	40					3.0	5.0	3.0	4.5	3.0	3.5
30	35					2.5	3.5	2.5	3.0	2.5	3.0
								1.5	3.0	1.5	3.0
50	60	25	35			4.5	6.0	4.0	5.0	2.5	3.0
40	45					4.5	6.0	4.0	5.0	2.5	3.0
50	60	25	35			4.5	6.0	4.0	5.0	3.0	3.5
40	45					4.0	5.5	3.5	4.5	3.0	3.5
50	60	25	35			3.5	5.0	3.0	4.5	3.0	3.5
35	40					3.5	5.0	3.0	4.5	2.5	3.5
30	40					3.0	4.0	2.5	3.5	2.0	3.0
40	50	20	30	350	450	2.5	4.5	3.0	5.0	2.5	4.0
50	60	20	30	300	400	3.0	4.5	3.0	5.0	2.5	3.5
40	45					3.0	4.5	3.0	4.5	2.5	3.5
30	40					2.5	4.0	2.5	4.0	2.0	3.0
50	60					3.0	4.5	3.0	5.0	2.5	3.5
35	40					3.0	4.5	3.0	4.5	2.5	3.5
35	50						4.0	3.0	4.0	2.0	3.0
50	60	25	35			4.5	6.0	4.0	5.0	3.0	4.0
40	45					3.0	5.0	3.0	4.5	2.5	3.5
30	40					2.5	4.5	2.5	4.0	2.0	3.0
50	60					4.5	6.0	4.0	5.0	3.0	4.0
50	60					4.5	6.0	4.0	5.0	3.0	4.0
								2.0	3.0	2.0	3.0
											3.0
40	50	25	35			3.0	4.5	3.0	5.0	3.0	4.0
50	60	25	35			4.5	6.0	4.0	5.0	3.0	4.0

TABLE 1.—*Estimated average acre yields of*

Soil	Corn				Oats	
	For silage		For grain			
	A	B	A	B	A	B
	Tons	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Red Hook gravelly loam	11	20	55	100	45	60
Rock outcrop						
Scio silt loam, 0 to 3 percent slopes	18	23	90	115	70	90
Scio silt loam, 3 to 8 percent slopes	16	20	80	100	70	90
Sun silt loam		20		100		70
Teel silt loam	20	25	100	125	60	70
Tioga silt loam	20	25	100	125	70	90
Tuller channery silt loam, 0 to 3 percent slopes						60
Tuller channery silt loam, 3 to 8 percent slopes		15		75	45	60
Varysburg gravelly loam, 2 to 8 percent slopes	16	20	80	100	70	90
Varysburg gravelly loam, 8 to 15 percent slopes	13	17	65	85	45	60
Varysburg gravelly loam, 15 to 25 percent slopes					45	50
Volusia channery silt loam, 0 to 3 percent slopes	12	17	60	85	45	60
Volusia channery silt loam, 3 to 8 percent slopes	12	17	60	85	50	65
Volusia channery silt loam, 8 to 15 percent slopes		15		75	45	60
Wallington silt loam	12	17	60	85	45	60
Wallkill silt loam						
Wayland silt loam		20		100		70
Williamson silt loam, 3 to 8 percent slopes	14	18	70	90	70	90
Williamson silt loam, 8 to 15 percent slopes	13	17	65	85	50	65
Williamson channery silt loam, 3 to 8 percent slopes	16	20	80	100	70	90
Williamson channery silt loam, 8 to 15 percent slopes	13	17	65	85	50	65

In table 3 soils are rated for eight elements of wildlife habitat, including grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood plants, coniferous plants, wetland food and cover plants, shallow dyked impoundments, and shallow excavated impoundments. Soils are also rated for three classes of wildlife—openland, woodland, and wetland (*1*).

The rating system is based on the relative suitability of the soil for the development and management of each individual habitat element. The class rating is based on an evaluation of the potential for developing all habitat elements that are essential to the particular class of wildlife. A rating of 1 indicates that the soil is well suited and has few limitations; 2 indicates the soil is suited but has moderate limitations; 3, that the soil is poorly suited because of severe limitations; and 4, that the soil is unsuitable.

Elements of wildlife habitat

Each soil is rated in table 3 according to its suitability for various kinds of plants or developments that make up the wildlife habitat element.

Grain and seed crops are such seed-producing annuals as corn, sorghum, wheat, barley, oats, millet, buckweat, and sunflower.

Grasses and legumes are domestic grasses and legumes that are established by planting. Among these are alfalfa, trefoil, clover, bluegrass, switchgrass, fescue, bromegrass, timothy, orchardgrass, and reed canarygrass.

Wild herbaceous upland plants are perennial grasses and weeds that generally are established naturally. They include bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, and dandelion.

Hardwood plants are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs, or foliage that wildlife eat. They generally are established naturally but can be planted. Among the native kinds are oak, beech, cherry, maple, birch, aspen, apple, hawthorn, dogwood, viburnum, grape, and briers.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Among the shrubs that can be grown on soils rated well suited are autumn-olive, amur honeysuckle, tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky dogwood. In addition, highbush cranberry, silky dogwood, and other shrubs with similar site requirements can be planted on soils that have a rating of suited. Hardwoods that are not available commercially can commonly be transplanted successfully.

Conifers consist of cone-bearing, evergreen trees and shrubs that are used by wildlife primarily as cover, though some provide browse and seeds. Among these are Norway spruce, white pine, white-cedar, and hemlock. It is important that living branches be maintained close to the ground so that food and cover are readily available to rabbits, pheasants, and other small animals. The lower branches die if trees form a dense canopy that shuts out the light. Planted conifers should be widely spaced to retard canopy closure.

Wetland food and cover plants are wild, herbaceous, annual and perennial plants that grow on moist to wet sites. They include smartweed, wild millet, rushes, spikerush, sedges, rice cutgrass, mannagrass, and cattails.

principal crops under two levels of management—Continued

Wheat		Dry beans		Potatoes		Hay					
						Alfalfa		Alfalfa-trefoil-grass		Trefoil-grass	
A	B	A	B	A	B	A	B	A	B	A	B
Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
-------	-------	20	30	250	400	-------	3.5	2.0	3.5	2.0	3.0
40	50	20	30	400	600	3.0	4.5	3.0	5.0	3.0	4.0
50	60	25	35	300	500	4.5	6.0	4.0	5.0	3.0	4.0
-------	-------	-------	-------	-------	-------	-------	-------	2.0	3.0	2.0	3.0
-------	-------	25	35	-------	-------	-------	-------	-------	5.0	3.0	4.0
50	60	25	35	500	600	4.5	6.0	4.0	5.0	3.0	4.0
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	1.0	3.0
30	40	-------	-------	-------	-------	-------	-------	1.5	3.0	1.5	3.0
50	60	25	35	-------	-------	5.0	6.0	4.5	5.0	3.0	4.0
40	45	-------	-------	-------	-------	4.5	6.0	4.0	5.0	3.0	4.0
30	40	-------	-------	-------	-------	5.0	6.0	4.5	5.0	2.0	3.5
35	50	-------	-------	-------	-------	1.0	3.0	2.0	3.0	1.0	3.0
40	50	-------	-------	-------	-------	1.0	3.0	2.0	3.0	1.0	3.0
-------	30	-------	-------	-------	-------	1.0	3.0	2.0	3.0	1.0	3.0
35	50	-------	-------	-------	-------	-------	3.0	2.0	3.5	2.0	3.5
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	1.0	2.5
-------	-------	-------	-------	-------	-------	-------	-------	2.0	3.5	2.0	3.5
50	60	25	35	350	500	4.5	6.0	4.5	5.0	3.0	4.0
40	45	-------	-------	-------	-------	3.0	4.5	3.0	4.5	2.5	3.5
50	60	25	35	350	500	5.0	6.0	4.5	5.0	3.0	4.0
40	45	-------	-------	-------	-------	3.0	4.5	3.0	4.5	2.5	3.5

Shallow diked impoundments can be developed if the soil is suitable for the construction of a low dike to impound shallow water. Included as impoundments are marshes, which receive surface runoff, and flooded duck fields or dry shallow ponds. Also included are fields used to grow domestic grains and then flooded in fall with as much as 18 inches of water from adjacent ponds or streams.

Shallow excavated impoundments are level ditches and potholes constructed on soils that have a high water table to create open-water areas that are mainly used by waterfowl.

Detailed field investigation of soil and site are needed to determine feasibility of water developments. Soil limitations for reservoir areas and embankments for ponds are presented, in table 6, on page 62, Interpretations of Engineering Properties. Fishponds are not included as a water development.

Classes of wildlife

The ratings for openland, woodland, and wetland wildlife are based on the ratings for selected essential habitat elements in the first part of the table in proportion to their significance for that class of wildlife. The rating for openland wildlife is based on the ratings for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood plants, and coniferous plants. The rating for woodland wildlife is based on the ratings listed for all the above elements except grain and seed crops. That for wetland wildlife is based on the ratings shown for wetland food and cover plants, shallow diked impoundments, and shallow excavated impoundments.

Examples of openland wildlife are pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their home in areas of cropland, pasture, meadow, and lawns and in areas overgrown by grasses, herbs, and shrubs.

Woodland wildlife are such birds and mammals as ruffed grouse, wild turkey, woodcock, thrush, vireo, scarlet tanager, gray and red squirrels, gray fox, white-tailed deer, and raccoon.

Wetland wildlife includes duck, geese, rail, heron, shore birds, redwing blackbird, mink, muskrat, and beaver. They normally live around ponds, marshes, swamps, or other wet areas.

Suitability ratings

Habitat element ratings are useful in—

1. Selecting the best soils for creating, improving, or maintaining specific wildlife habitat elements.
2. Determining the relative intensity of management required for individual habitat elements.
3. Avoiding sites that would be difficult or not feasible to manage.

Ratings for classes of wildlife are useful in—

1. Planning the broad use of land for wildlife refuges, nature-study areas, or other developments for wildlife.
2. Determining areas that are suitable for acquisition for wildlife development.

TABLE 2.—*Woodland suitability groups*

[Alluvial land (Am) and Rock outcrop (Ro) generally are not suitable as commercial

Woodland suitability group, brief description of soils, and map symbols	Potential productivity	
	Indicator species	Estimated site index
Group 2r1. Deep, well drained or moderately well drained, moderately steep and steep, medium-textured soils. Lime content ranges from medium to low. Rooting depth is more than 20 inches. Arkport (ArD, ArE); Collamer (CoD); Nunda (NuD).	Sugar maple	65–75
Group 2r2. Deep, well drained or moderately well drained, moderately sloping, medium-textured soils. Lime content ranges from medium to very low. Rooting depth is more than 20 inches. Allard (AlC); Canaseraga (CcC); Collamer (CoC); Nunda (NuC); Williamson (WoC, WsC).	Sugar maple	65–75
Group 2r3. Deep, somewhat excessively drained to moderately well drained, moderately steep or steep, medium-textured, gravelly or shaly soils. Lime content ranges from very low to medium. Rooting depth is more than 20 inches. Howard (HmD); Howard-Madrid (HoD, HrD); Howard and Chenango (HsE); Lansing (LgD, LgE); Varysburg (VaD).	Sugar maple	65–75
Group 2o1. Deep, well drained and moderately well drained, nearly level to moderately sloping, medium-textured soils. Lime content ranges from medium to very low. Rooting depth is more than 20 inches. Allard (AlA, AlB); Arkport (ArB, ArC); Canaseraga (CcA, CcB); Collamer (CoB); Nunda (NuB); Scio (ScA, ScB); Williamson (WoB, WsB).	Sugar maple	65–75
Group 2o2. Well drained to excessively drained or moderately well drained, nearly level to moderately sloping, medium textured and moderately coarse textured soils. All the soils are deep, except for the Aurora soil, which is 20 to 40 inches deep over shale. Lime content ranges from medium to high. Rooting depth is more than 20 inches. Aurora (AuC); Conesus (CrA, CrB, CrC); Danley (DeB, DeC); Herkimer (HeA, HeB); Howard (HmA, HmB, HmC, HnA, HnB, HnC); Howard-Madrid (HoB, HoC, HrB, HrC); Lansing (LgB, LgC); Madrid (MaB, MaC, MdB, MdC); Palmyra (PgA, PgB); Phelps (PpA, PpB); Varysburg (VaB, VaC).	Sugar maple	65–75
Group 2o3. Deep, well drained and mainly moderately well drained, nearly level, medium-textured soils on flood plains. Teel soil is somewhat poorly drained in places. Lime content ranges from medium to low. Rooting depth is more than 20 inches. These soils are subject to occasional flooding. Hamlin (Hc); Teel (Te); Tioga (Tg).	Sugar maple	65–75
Group 3w1. Deep and moderately deep, dominantly somewhat poorly drained, nearly level to moderately sloping, medium-textured soils. The Aurora soil is moderately well drained. Lime content is medium. Rooting depth is mainly less than 20 inches because of a seasonal high water table. Angola (AnA); Angola and Aurora (AoB); Appleton (ApA, ApB); Burdett (BuA, BuB); Darien (DnA, DnB, DnC); Niagara (Ng).	Sugar maple	55–65
Group 3w2. Dominantly somewhat poorly drained, nearly level and gently sloping soils that have a medium-textured surface layer and a fine textured or moderately fine textured subsoil. Caneadea and Hornell soils are moderately well drained in places. All the soils are deep, except for the Hornell soils, which are 20 to 40 inches deep over shale. Lime content ranges from very low to high. Rooting depth is mainly less than 20 inches because of a seasonal high water table. Caneadea (CdA, CdB); Churchville (CnB); Fremont (FrA, FrB); Hornell (HlA, HlB).	Sugar maple	55–65
Group 3w3. Dominantly somewhat poorly drained, moderately sloping soils that have a medium-textured surface layer and a fine textured or moderately fine textured subsoil. Caneadea and Hornell soils are moderately well drained in places. All the soils are deep, except for the Hornell soil, which is 20 to 40 inches deep over shale. Lime content ranges from very low to high. Rooting depth is mainly less than 20 inches because of a seasonal high water table. Caneadea (CdC); Churchville (CnC); Fremont (FsC); Hornell (HlC).	Sugar maple	55–65
Group 3w4. Deep, somewhat poorly drained, nearly level, medium-textured, gravelly soils. Lime content ranges from low to high. Rooting depth is mainly less than 20 inches because of a persistent seasonal high water table. Homer (Hg, Hh); Red Hook (Rh).	Red maple	70–80

and factors in woodland management

woodland and therefore have not been placed in a woodland suitability group]

Factors affecting management						Species to favor—	
Erosion hazard	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard	In existing stands	For planting
			Hardwoods	Conifers			
Moderate	Moderate	Slight	Moderate	Severe	Slight	Sugar maple, basswood, black cherry, ash, red oak, yellow-poplar.	White pine, Norway spruce, white spruce, larch, black walnut, Scotch pine, balsam fir, Douglas-fir.
Moderate	Slight	Slight	Moderate	Severe	Slight	Sugar maple, white pine, red oak, basswood, ash, black cherry.	White pine, Norway spruce, white spruce, red pine, larch, Scotch pine, balsam fir, Douglas-fir.
Slight	Moderate	Slight	Moderate	Severe	Slight	Sugar maple, red oak, white pine, ash, hemlock, black cherry.	White pine, larch, Scotch pine, balsam fir, Douglas-fir.
Slight	Slight	Slight	Moderate	Severe	Slight	Sugar maple, basswood, black cherry, ash, red oak.	White pine, Norway spruce, white spruce, larch, red pine, Scotch pine, balsam fir, Douglas-fir.
Slight	Slight	Slight	Moderate	Severe	Slight	Sugar maple, basswood, black cherry, ash, red oak, yellow-poplar, hemlock, white pine.	White pine, white spruce, Norway spruce, larch, black locust, Scotch pine, balsam fir, Douglas-fir.
Slight	Slight	Slight	Moderate	Severe	Slight	Sugar maple, red oak, ash, basswood.	White pine, Norway spruce, white spruce, larch, black walnut.
Slight	Moderate	Slight	Moderate	Severe	Slight to moderate.	Sugar maple, red oak, black cherry, ash, basswood, hemlock.	White pine, larch, Norway spruce, white spruce, Scotch pine, balsam fir, Douglas-fir.
Slight	Moderate	Moderate	Moderate	Severe	Moderate	Sugar maple, red maple, ash, basswood, black cherry, red oak.	White pine, Norway spruce, white spruce, larch, Scotch pine, balsam fir, Douglas-fir.
Moderate	Moderate	Moderate	Moderate	Severe	Moderate	Sugar maple, red maple, ash, basswood, black cherry, red oak.	White pine, Norway spruce, white spruce, larch, Scotch pine, balsam fir, Douglas-fir.
Slight	Moderate	Moderate	Severe	Severe	Moderate	Red maple, sugar maple, basswood, white pine, hemlock.	White pine, white spruce.

TABLE 2.—*Woodland suitability groups*

Woodland suitability group, brief description of soils, and map symbols	Potential productivity: Indicator species	Potential productivity: Estimated site index
Group 3w5. Deep, somewhat poorly drained, nearly level to moderately sloping, medium-textured soils. Lime content ranges from low to very low. Rooting depth is restricted to less than 20 inches by a fragipan. Dalton (DaA, DaB); Erie (ErA, EsB, EsC); Volusia (VoA, VoB, VoC); Wallington (Wa).	Sugar maple	55–65
Group 3r1. Dominantly well drained or moderately well drained, moderately steep and steep, medium-textured soils. All the soils are deep, except for the Lordstown and Manlius soils, which are 20 to 40 inches deep over bedrock. Drainage ranges from well drained to excessively drained in Manlius soils and from well drained to somewhat excessively drained in the Chenango soil in places. Lime content is low and very low. Rooting depth is mainly more than 20 inches. Bath (BaD, BaE); Bath-Valois (BlD); Chenango (ClD); Langford (LaD); Lordstown (LoD, LoE); Manlius (MlD, MlE); Mardin (MrD).	Sugar maple	55–65
Group 3r2. Moderately well drained to somewhat poorly drained, moderately steep and steep, mainly fine textured soils. All the soils are deep, except for the Hornell soils, which are 20 to 40 inches deep over shale bedrock. Lime content ranges from very low to medium. Rooting depth generally is less than 20 inches. These soils are erodible and, where cleared, commonly have lost much of the original surface layer. Caneadea (CeD3, CeE3); Danley (DlD3, DlE3); Fremont and Hornell (FtD, FtE).	Sugar maple	55–65
Group 3o1. Dominantly well drained or moderately well drained, nearly level to moderately sloping, medium-textured soils. All the soils are deep, except the Lordstown and Manlius soils, which are 20 to 40 inches deep over bedrock. Drainage ranges from well drained to excessively drained in Manlius soils in places and from well drained to somewhat excessively drained in Chenango soils. Lime content is very low to low. Rooting depth generally is more than 20 inches, except for the Langford and Mardin soils, which are as shallow as 14 inches in places. Bath (BaA, BaB, BaC); Bath-Valois (BlA, BlB, BlC); Castile (CgA, CgB, ChA); Chenango (ClA, ClB, ClC, CmB); Langford (LaA, LaB, LaC); Lordstown (LoB, LoC); Manlius (MlB, MlC); Mardin (MrA, MrB, MrC); Marilla (MsB, MsC).	Sugar maple	55–65
Group 4w1. Deep, dominantly very poorly drained, level or nearly level, medium-textured soils, that are high in organic matter and organic soils. Lime content ranges from high to low. Rooting depth is restricted mainly to the top few inches because of a prolonged high water table. These soils are frequently ponded. Alden (Ad); Palms (Pa); Papakating (Pm); Wallkill (Wk).	Red maple	60–70
Group 4w2. Deep, poorly drained and very poorly drained, level or nearly level, medium textured and moderately fine textured soils. Lime content ranges from high to low. Rooting depth is restricted mainly to the upper 6 to 15 inches because of a prolonged high water table. Occasionally these soils are ponded, especially early in spring. Candice (Ca); Ellery (Ee); Halsey (Ha); Ilion (In); Lyons (Ly); Papakating (Pk); Sun (Su); Wayland (Wn).	Red maple	60–70
Group 4d1. Shallow, well drained and moderately well drained, gently sloping to moderately sloping, medium-textured soils. Lime content is very low. Rooting depth is restricted to the top 10 to 20 inches by bedrock. Arnot (AtB, AtC).	Sugar maple	50–60
Group 4r1. Moderately deep, well drained to excessively drained, very steep, medium-textured soils. Lime content is very low. Rock outcrop is common, and the rooting depths are variable from place to place. Manlius and Lordstown (MnF).	Sugar maple	50–60
Group 5w1. Shallow, somewhat poorly drained to poorly drained, nearly level to gently sloping, medium-textured soils. Lime content is very low. Rooting depth is restricted to the upper 10 to 20 inches by bedrock and a seasonal high water table. Tuller (TuA, TuB).	Red maple	50–60

and factors in woodland management—Continued

Factors affecting management						Species to favor—	
Erosion hazard	Equipment limitations	Seedling mortality	Plant competition: Hardwoods	Plant competition: Conifers	Windthrow hazard	In existing stands	For planting
Slight	Moderate	Moderate	Moderate	Severe	Moderate	Sugar maple, red oak, black cherry, ash, hemlock, white pine, basswood, red maple.	White pine, Norway spruce, white spruce, larch, Scotch pine, balsam fir, Douglas-fir.
Slight to moderate.	Moderate	Slight	Slight	Moderate	Slight	Sugar maple, red oak, black cherry, ash, white pine, hemlock, red maple.	White pine, Norway spruce, white spruce, larch, red pine, Scotch pine, balsam fir, Douglas-fir.
Severe	Moderate	Moderate	Moderate	Severe	Moderate	Sugar maple, red oak, basswood, ash, black cherry.	White pine, Norway spruce, white spruce, larch, Scotch pine, balsam fir, Douglas-fir.
Slight	Slight	Slight	Slight	Moderate	Slight to moderate.	Sugar maple, white oak, red oak, black cherry, ash, white pine, hemlock.	White pine, red pine, Norway spruce, white spruce, larch, Scotch pine, balsam fir, Douglas-fir.
Slight	Severe	Severe	Severe	Severe	Severe	Red maple, hemlock, white pine.	Unplantable.
Slight	Severe	Severe	Severe	Severe	Moderate	Red maple, white pine, hemlock.	White pine, white spruce, Norway spruce.
Slight	Slight	Moderate	Slight	Moderate	Moderate	Sugar maple, red oak, white oak, white pine, hemlock.	White pine, Scotch pine, balsam fir, Douglas-fir.
Severe	Severe	Slight	Slight	Moderate	Slight to moderate.	Sugar maple, black cherry, ash, white pine, red pine, hemlock.	Too steep to plant.
Slight	Severe	Severe	Severe	Severe	Severe	Red maple, hemlock	White pine, white spruce.

TABLE 3.—*Rating of soils for wildlife*

[A rating of 1 indicates that the soil is well suited; 2, the soil is suited;

Soil name	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Alden mucky silt loam	4	3	3
Allard silt loam, 0 to 3 percent slopes	1	1	1
Allard silt loam, 3 to 8 percent slopes	2	1	1
Allard silt loam, 8 to 15 percent slopes	2	1	1
Angola shaly silt loam, 0 to 3 percent slopes	2	2	1
Angola and Aurora shaly silt loams, 3 to 8 percent slopes	2	2	1
Appleton gravelly silt loam, 0 to 3 percent slopes	2	2	1
Appleton gravelly silt loam, 3 to 8 percent slopes	2	2	1
Arkport very fine sandy loam, 2 to 8 percent slopes	2	1	1
Arkport very fine sandy loam, 8 to 15 percent slopes	2	1	1
Arkport very fine sandy loam, 15 to 25 percent slopes	3	2	1
Arkport very fine sandy loam, 25 to 40 percent slopes	4	3	1
Arnot channery silt loam, 2 to 8 percent slopes	2	2	2
Arnot channery silt loam, 8 to 15 percent slopes	2	2	2
Aurora shaly silt loam, 8 to 15 percent slopes	2	1	1
Bath channery silt loam, 0 to 3 percent slopes	1	1	1
Bath channery silt loam, 3 to 8 percent slopes	2	1	1
Bath channery silt loam, 8 to 15 percent slopes	2	1	1
Bath channery silt loam, 15 to 25 percent slopes	3	2	1
Bath channery silt loam, 25 to 40 percent slopes	4	3	1
Bath-Valois gravelly loams, 0 to 3 percent slopes	1	1	1
Bath-Valois gravelly loams, 3 to 8 percent slopes	2	1	1
Bath-Valois gravelly loams, 8 to 15 percent	2	1	1
Bath-Valois gravelly loams, 15 to 25 percent slopes	3	2	1
Burdett silt loam, 0 to 3 percent slopes	2	2	1
Burdett silt loam, 3 to 8 percent slopes	2	2	1
Canadice silty clay loam	4	3	3
Canaseraga silt loam, 0 to 3 percent slopes	2	1	1
Canaseraga silt loam, 3 to 8 percent slopes	2	1	1
Canaseraga silt loam, 8 to 15 percent slopes	2	1	1
Caneadea silt loam, 0 to 3 percent slopes	2	2	1
Caneadea silt loam, 3 to 8 percent slopes	2	2	1
Caneadea silt loam, 8 to 15 percent slopes	2	2	1
Caneadea silty clay loam, 15 to 25 percent slopes, eroded	4	2	1
Caneadea silty clay loam, 25 to 50 percent slopes, eroded	4	3	1
Castile gravelly loam, 0 to 3 percent slopes	3	2	2
Castile gravelly loam, 3 to 8 percent slopes	3	2	2
Castile channery silt loam, fans, 0 to 3 percent slopes	3	2	2
Chenango gravelly loam, 0 to 3 percent slopes	2	2	2
Chenango gravelly loam, 3 to 8 percent slopes	2	2	2
Chenango gravelly loam, 8 to 15 percent slopes	2	2	2
Chenango gravelly loam, 15 to 25 percent slopes	3	2	2
Chenango channery silt loam, fans, 3 to 8 percent slopes	2	2	2
Churchville silt loam, 2 to 8 percent slopes	2	2	1
Churchville silt loam, 8 to 15 percent slopes	2	2	1
Collamer silt loam, 3 to 8 percent slopes	2	1	1
Collamer silt loam, 8 to 15 percent slopes	2	1	1
Collamer silt loam, 15 to 25 percent slopes	3	2	1
Conesus gravelly silt loam, 0 to 3 percent slopes	2	1	1
Conesus gravelly silt loam, 3 to 8 percent slopes	2	1	1
Conesus gravelly silt loam, 8 to 15 percent slopes	2	1	1
Dalton silt loam, 0 to 3 percent slopes	2	2	2
Dalton silt loam, 3 to 8 percent slopes	2	2	2
Danley silt loam, 3 to 8 percent slopes	2	1	1
Danley silt loam, 8 to 15 percent slopes	2	1	1
Danley silty clay loam, 15 to 25 percent slopes, eroded	4	2	1
Danley silty clay loam, 25 to 40 percent slopes, eroded	4	3	1
Darien silt loam, 0 to 3 percent slopes	2	2	1
Darien silt loam, 3 to 8 percent slopes	2	2	1
Darien silt loam, 8 to 15 percent slopes	2	2	1
Ellery silt loam	4	3	3
Erie silt loam, 0 to 3 percent slopes	3	2	2
Erie channery silt loam, 3 to 8 percent slopes	3	2	2
Erie channery silt loam, 8 to 15 percent slopes	3	2	2
Fremont silt loam, 0 to 3 percent slopes	2	2	1
Fremont silt loam, 3 to 8 percent slopes	2	2	1
Fremont channery silt loam, 8 to 15 percent slopes	2	2	1

habitat elements and classes of wildlife

3, poorly suited; and 4, unsuited. Not rated are Alluvial land and Rock outcrop]

Wildlife habitat elements—Continued					Classes of wildlife		
Hardwood plants	Coniferous plants	Wetland food and cover plants	Shallow diked impoundments	Shallow excavated impoundments	Openland	Woodland	Wetland
2	3	1	2	1	3	3	1
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	2	3	3	3	2	1	3
1	2	3	4	4	2	1	4
1	2	3	2	2	2	1	2
1	2	3	4	4	2	1	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	3	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	2	2	4
1	3	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	2	2	4
1	1	4	4	4	3	2	4
1	1	4	3	4	1	1	3
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	2	2	4
1	2	3	2	2	2	1	2
1	2	3	4	4	2	1	4
2	2	2	2	1	3	2	2
2	2	4	2	3	1	2	2
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
1	2	3	2	2	2	1	2
1	2	3	4	4	2	1	4
1	2	4	4	4	2	1	4
1	2	4	4	4	2	2	4
1	2	4	4	4	3	2	4
2	3	4	4	4	2	2	4
2	3	4	4	4	2	2	4
2	3	4	4	4	2	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	2	2	4
1	2	3	4	4	2	1	4
1	2	4	4	4	2	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	2	2	4
1	1	4	2	3	1	1	2
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
2	2	3	2	2	2	2	2
2	2	3	4	4	2	2	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	2	2	4
1	1	4	4	4	3	2	4
1	2	3	2	2	2	1	2
1	2	3	4	4	2	1	4
1	2	4	4	4	2	1	4
2	2	2	2	1	3	2	2
2	2	3	2	2	2	2	2
2	2	3	4	4	2	2	4
2	2	4	4	4	2	2	4
1	2	3	3	2	2	1	3
1	2	3	4	4	2	1	4
1	2	4	4	4	2	1	4

TABLE 3.—*Rating of soils for wildlife*

Soil name	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Fremont and Hornell soils, 15 to 25 percent slopes	3	2	1
Fremont and Hornell soils, 25 to 40 percent slopes	4	3	1
Halsey loam	4	3	3
Hamlin silt loam	2	1	1
Herkimer shaly silt loam, 0 to 3 percent slopes	1	1	1
Herkimer shaly silt loam, 3 to 8 percent slopes	2	1	1
Homer gravelly loam	2	2	1
Homer gravelly loam, clayey substratum	2	2	1
Hornell silt loam, 0 to 3 percent slopes	2	2	1
Hornell silt loam, 3 to 8 percent slopes	2	2	1
Hornell silt loam, 8 to 15 percent slopes	2	2	1
Howard gravelly loam, 0 to 3 percent slopes	2	1	1
Howard gravelly loam, 3 to 8 percent slopes	2	1	1
Howard gravelly loam, 8 to 15 percent sllopes	2	1	1
Howard gravelly loam, 15 to 25 percent slopes	3	2	1
Howard shaly silt loam, 0 to 3 percent slopes	2	1	1
Howard shaly silt loam, 3 to 8 percent slopes	2	1	1
Howard shaly silt loam, 8 to 15 percent slopes	2	1	1
Howard-Madrid gravelly loams, 3 to 8 percent slopes	2	1	1
Howard-Madrid gravelly loams, 8 to 15 percent slopes	2	1	1
Howard-Madrid gravelly loams, 15 to 25 percent slopes	3	2	1
Howard-Madrid shaly silt loams, 3 to 8 percent slopes	2	1	1
Howard-Madrid shaly silt loams, 8 to 15 percent slopes	2	1	1
Howard-Madrid shaly silt loams, 15 to 25 percent slopes	3	2	1
Howard and Chenango soils, 25 to 40 percent slopes	4	3	1
Ilion silt loam	4	3	3
Langford channery silt loam, 0 to 3 percent slopes	2	1	1
Langford channery silt loam, 3 to 8 percent slopes	2	1	1
Langford channery silt loam, 8 to 15 percent slopes	2	1	1
Langford channery silt loam, 15 to 25 percent slopes	3	2	1
Lansing gravelly silt loam, 2 to 8 percent slopes	2	1	1
Lansing gravelly silt loam, 8 to 15 percent slopes	2	1	1
Lansing gravelly silt loam, 15 to 25 percent slopes	3	2	1
Lansing gravelly silt loam, 25 to 40 percent slopes	4	3	1
Lordstown channery silt loam, 2 to 8 percent slopes	2	2	1
Lordstown channery silt loam, 8 to 15 percent slopes	2	2	1
Lordstown channery silt loam, 15 to 25 percent slopes	3	2	1
Lordstown channery silt loam, 25 to 40 percent slopes	4	3	1
Lyons silt loam	4	3	3
Madrid fine sandy loam, 2 to 8 percent slopes	2	1	1
Madrid fine sandy loam, 8 to 15 percent	2	1	1
Madrid loam, 2 to 8 percent slopes	2	1	1
Madrid loam, 8 to 15 percent slopes	2	1	1
Manlius shaly silt loam, 2 to 8 percent slopes	3	2	2
Manlius shaly silt loam, 8 to 15 percent slopes	3	2	2
Manlius shaly silt loam, 15 to 25 percent slopes	3	2	2
Manlius shaly silt loam, 25 to 40 percent slopes	4	3	2
Manlius and Lordstown soils, 40 to 90 percent slopes	4	4	2
Mardin channery silt loam, 0 to 3 percent slopes	2	1	1
Mardin channery silt loam, 3 to 8 percent slopes	2	1	1
Mardin channery silt loam, 8 to 15 percent slopes	2	1	1
Mardin channery silt loam, 15 to 25 percent slopes	3	2	1
Marilla shaly silt loam, 2 to 8 percent slopes	2	1	1
Marilla shaly silt loam, 8 to 15 percent slopes	2	1	1
Niagara silt loam	2	2	1
Nunda silt loam, 2 to 8 percent slopes	2	1	1
Nunda silt loam, 8 to 15 percent slopes	2	1	1
Nunda silt loam, 15 to 25 percent slopes	3	2	1
Palms muck	4	3	3
Palmyra gravelly loam, 0 to 3 percent slopes	2	1	1
Palmyra gravelly loam, 3 to 8 percent slopes	2	1	1
Papakating silt loam	4	3	3
Papakating mucky silt loam	4	3	3
Phelps gravelly loam, 0 to 3 percent slopes	2	1	1
Phelps gravelly loam, 3 to 8 percent slopes	2	1	1
Red Hook gravelly loam	2	2	1
Scio silt loam, 0 to 3 percent slopes	2	1	1
Scio silt loam, 3 to 8 percent slopes	2	1	1

habitat elements and classes of wildlife—Continued

Wildlife habitat elements—Continued					Classes of wildlife		
Hardwood plants	Coniferous plants	Wetland food and cover plants	Shallow diked impoundments	Shallow excavated impoundments	Openland	Woodland	Wetland
1	2	4	4	4	2	1	4
1	2	4	4	4	3	2	4
2	3	1	3	4	3	3	3
1	1	4	3	4	1	1	3
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	2	3	4	4	2	1	4
1	2	3	3	3	2	1	3
1	2	3	3	3	2	1	3
1	2	3	4	4	2	1	4
1	2	4	4	4	2	1	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	3	2	4
2	2	2	3	3	3	2	3
2	2	4	2	3	1	2	2
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	2	2	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	2	2	4
1	1	4	4	4	3	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	3	2	4
2	2	2	2	2	3	2	2
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
2	3	4	4	4	2	2	4
2	3	4	4	4	2	2	4
2	3	4	4	4	2	2	4
2	3	4	4	4	3	2	4
2	3	4	4	4	4	2	4
2	2	4	2	3	1	2	2
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	2	2	4
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
1	2	3	2	2	2	1	2
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	2	2	4
2	2	1	4	2	3	3	2
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
2	2	1	3	3	3	2	3
2	2	1	3	3	3	2	3
2	2	4	4	4	1	2	4
2	2	4	4	4	1	2	4
1	2	3	4	4	2	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4

TABLE 3.—*Rating of soils for wildlife*

Soil name	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Sun silt loam	4	3	3
Teel silt loam	2	1	1
Tioga silt loam	2	1	1
Tuller channery silt loam, 0 to 3 percent slopes	3	2	2
Tuller channery silt loam, 3 to 8 percent slopes	3	2	2
Varysburg gravelly loam, 2 to 8 percent slopes	2	1	1
Varysburg gravelly loam, 8 to 15 percent slopes	2	1	1
Varysburg gravelly loam, 15 to 25 percent slopes	3	2	1
Volusia channery silt loam, 0 to 3 percent slopes	3	2	2
Volusia channery silt loam, 3 to 8 percent slopes	3	2	2
Volusia channery silt loam, 8 to 15 percent slopes	3	2	2
Wallington silt loam	2	2	1
Wallkill silt loam	4	3	3
Wayland silt loam	4	3	3
Williamson silt loam, 3 to 8 percent slopes	2	1	1
Williamson silt loam, 8 to 15 percent slopes	2	1	1
Williamson channery silt loam, 3 to 8 percent slopes	2	1	1
Williamson channery silt loam, 8 to 15 percent slopes	2	1	1

Engineering Uses of the Soils[7]

Some soil properties are of special interest to engineers because they affect the design, construction, and maintenance of roads, airports, pipelines, building foundations, and sewage disposal systems. Among the properties important in engineering are permeability, shear strength, grain size, compaction characteristics, drainage, plasticity, and reaction. Also important are relief, depth to water table, depth to bedrock, and kind of bedrock.

Information in this survey can be used to—

1. Make studies that aid in selecting and developing sites for industrial, commercial, residential, and recreational purposes.
2. Make preliminary estimates of soil properties that are significant in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other construction material.
5. Correlate performance of engineering structures with soils and thus gain information that is useful in planning the design and in maintaining the structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and from aerial photographs for the purpose of making maps and reports that can be used readily by others.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

[7] By JOHN B. FLECKENSTEIN, senior agronomist, State of New York. Department of Transportation, Soil Mechanics Bureau; and by DONALD L. BASINGER, assistant state conservation engineer, and DONALD F. FLORA, soil scientist, Soil Conservation Service.

Using the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they do not eliminate the need for sampling and testing at the site of specific engineering works. This engineering section, with the soil map and the soil descriptions, is useful for planning more detailed field investigatoins and for suggesting the kinds of problems that can be expected.

Tables 4, 5, and 6 give information and interpretations significant to engineers. Additional information about the soils can be found in other sections of the survey, particularly in the section "Descriptions of the Soils" and the section "Formation, Morphology, and Classification of the Soils."

Some of the terms used by soil scientists are not familiar to engineers, and some terms—for example, clay, silt, and sand—have a special meaning in soil science. These terms and others are defined in the Glossary. The following are definitions of several terms used in this section of the survey.

Compressibility.—Property of a soil pertaining to its susceptibility to decrease in volume when subjected to load.

Liquid limit.—The moisture content at which the soil material passes from a plastic to a viscous, semiliquid state.

Moisture Content.—The ratio of the weight of water contained in the soil to the dry weight of the soil. It generally is expressed as a percentage.

Moisture-density relations.—If a soil material is compacted at a successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed maximum dry density. The moisture-density relationship is important to

habitat elements and classes of wildlife—Continued

Wildlife habitat elements—Continued					Classes of wildlife		
Hardwood plants	Coniferous plants	Wetland food and cover plants	Shallow diked impoundments	Shallow excavated impoundments	Openland	Woodland	Wetland
2	3	1	2	2	3	2	2
1	1	4	3	3	1	1	3
1	1	4	3	4	1	1	3
2	1	3	4	4	2	2	4
2	1	3	4	4	2	2	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	2	2	4
2	2	3	2	2	2	2	2
2	2	3	4	4	2	2	4
2	2	4	4	4	2	2	4
2	2	3	4	4	2	2	4
2	3	1	4	2	3	2	3
2	2	2	3	3	3	2	3
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4
1	1	4	4	4	1	1	4

earthwork, for, as a rule, optimum stability is obtained for any given compactive effort if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Plastic limit.—The moisture content at which the soil material passes from a semisolid to a plastic state.

Plasticity index.—The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Shear strength.—The ability to resist sliding along internal surfaces within a soil mass when external forces are applied.

Shrink-swell potential.—An indication of the volume change to be expected of the soil material with changes in moisture content.

Strength.—The resistance to deformation of the soil mass from applied loads. In this report it is expressed as the relative estimated load-carrying capacity, and should not be used for design purposes.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*8*) used by the Soil Conservation Service engineers, Department of Defense, and others, and the AASHO system (*2*) adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes, is designated by symbols for both classes; for example, GM–GC.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 4; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

In the system used by soil scientists of the U.S. Department of Agriculture, the texture of the soil horizon depends on the proportional amounts of the different sized mineral particles. The percentage of soil material smaller than 2.0 millimeters (classified as clay, silt, and sand) determines the basic textural classification, such as sandy loam or loamy sand. Coarse fragments greater than 2.0 millimeters, such as gravel or stone, become part of the textural class if they occupy more than 15 percent, by volume, of the soil mass (*6*).

Engineering test data

Table 4 contains the results of engineering tests performed by the State of New York Department of Transportation, Soil Mechanics Bureau, on soils of 14 series in Wyoming County. These soils formed in highly variable glacial till and water-deposited material. They vary greatly in texture. Thus, the engineering soil classification given in table 4 does not apply to all parts of the mapping unit. It does, however, apply to the soil as it occurs throughout most of its acreage in the county. In establishing the engineering soil classification, particles larger than 3 inches in diameter were not considered.

TABLE 4.—*Engineering*

[Tests performed by New York State Department of Transportation, Soil Mechanics Bureau, in accordance with standard

Soil name and location	Parent material	Depth	Moisture density data[1]		In place moisture content[2]	In place dry density[3]	Lineal shrinkage	Reaction	Organic matter[4]	Percolation rate[5]
			Maximum dry density	Optimum moisture						
		In.	*Lb. per cu. ft.*	*Pct.*				*pH*		*Min./in.*
Bath channery silt loam:										
Town of Castile, 2 miles south of Perry on Upper Reservation Road. (Modal)	Acid glacial till derived mainly from sandstone and shale.	0–9	105	17	8	82	3.4	5.8	3.8	--------
		9–24	114	13	6	92	3.4	5.3	1.4	--------
		24–29	125	11	6	116	2.0	5.2	0.3	42.2
		29–46	126	11	7	115	5.6	5.1	0.3	--------
		46–58	125	11	8	109	4.0	5.0	------	>120
Town of Bennington, 0.5 mile west of Bennington Center on State Route 354, south side of road. (Less channery than modal)	Acid glacial till derived mainly from shale and siltstone.	0–10	90	27	22	79	6.6	6.2	6.0	--------
		10–24	98	21	12	82	3.4	5.1	2.3	25.9
		24–32	120	13	7	108	4.0	7.0	1.1	--------
		32–66	119	13	9	114	4.6	5.1	1.0	25.9
Bath gravelly loam:										
Town of Castile, 2.5 miles south-southwest of Perry, 500 yards east of M. Clark Road. (Gravelly loam phase)	Acid glacial till derived mainly from sandstone and shale.	0–7	112	14	--------	--------	2.8	4.7	4.3	--------
		7–26	120	13	6	199	3.0	5.3	0.8	9.9
		26–33	129	10	6	114	0.4	5.4	0.3	--------
		33–50	123	11	8	109	1.6	5.6	0.3	--------
		50–74	124	11	8	113	1.6	6.0	------	--------
		74–114	124	9	8	110	2.0	5.9	------	>120
Caneadea silt loam:										
Town of Java, 2 miles southwest of Java Village on Day Road on the Wyoming and Erie County line. (Modal)	Calcareous lacustrine silts and clays.	0–6	86	31	20	70	7.6	5.8	8.3	--------
		6–11	93	25	18	85	5.6	5.1	3.2	--------
		11–28	96	25	22	98	11.6	7.0	1.0	--------
		28–50	101	22	21	102	7.0	7.4	------	>120
Chenango gravelly loam:										
Town of Castile, 1.5 miles east of Castile Village on DeGolyer Road. (Modal)	Acid glacial outwash derived mainly from sandstone and shale.	0–10	118	12	--------	--------	4.0	6.1	3.2	--------
		10–21	127	10	--------	--------	2.2	6.1	1.0	0.6
		21–38	125	10	--------	--------	4.4	5.4	0.7	0.6
		38–46	130	9	--------	--------	8.0	5.5		--------
		46–60	124	11	9	108	0.4	8.0	------	0.6
Churchville silt loam:										
Town of Castile, 2 miles east of Castile Village on County Road 6, 200 yards east of road.	Multiple deposits of lacustrine silts and clays over sandstone and shale till.	0–6	98	21	10	87	7.6	6.6	4.7	--------
		6–18	106	19	9	93	6.4	5.4	0.8	--------
		18–30	111	16	11	111	8.0	7.0	1.1	>120
		30–39	120	12	9	120	5.4	8.0	0.5	--------
		39–46	130	9	7	122	2.0	8.0	------	>120
Dalton silt loam:										
Town of Bennington, 2.4 miles south of Bennington Center on Poland Road.	Deposits of silts over acid till derived mainly from shale and siltstone.	0–7	93	25	21	81	6.0	4.9	4.1	--------
		7–11	104	20	13	94	3.0	5.1	1.2	--------
		11–22	111	16	13	109	4.6	4.8	0.6	--------
		22–65	125	11	14	114	6.0	7.4	0.4	>120
		65–85	122	12	16	111	6.4	6.8	------	>120

See footnotes at end of table.

test data

procedures of the American Association of State Highway Officials (AASHO). The symbol > means more than]

Coarse fragments more than 3 inches discarded	Mechanical analysis [6]											Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—							Percentage smaller than—						AASHO	Unified
	3 in.	1½ in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
Pct.												*Pct.*			
3	97	94	84	69	64	57	49	(8)	------	------	------	33	8	A-4(3)	GM-GC
2	98	90	83	69	63	56	47	37	19	8	3	22	3	A-4(2)	GM
------------	100	93	80	65	59	50	37	29	13	5	2	------	NP	A-4(0)	GM
4	96	85	76	65	59	52	40	32	16	9	4	22	5	A-4(1)	GM-GC
2	98	90	83	65	56	46	37	29	13	7	4	21	5	A-4(0)	GM-GC
------------	100	99	96	81	74	65	50	(8)	------	------	------	41	10	A-5(3)	SM
------------	100	98	96	79	74	66	48	38	17	5	2	------	NP	A-4(3)	SM
------------	100	99	90	71	65	54	36	30	17	9	4	20	5	A-4(0)	SM-SC
------------	100	93	84	61	53	40	26	22	16	11	4	24	8	A-2-4(0)	GC
------------	100	93	82	63	56	49	41	(8)	------	------	------	31	6	A-4(1)	GM-GC
------------	100	93	79	58	50	41	33	26	14	5	1	22	6	A-2-4(0)	GM-GC
------------	100	90	80	63	56	46	37	29	12	4	2	------	NP	A-4(0)	GM
10	89	81	70	56	50	44	36	28	12	4	2	------	NP	A-2-4(0)	GM
10	93	82	74	60	54	46	37	29	12	4	2	------	NP	A-4(0)	GM
------------	------	98	90	70	60	44	25	19	7	3	1	------	NP	A-1-b(0)	SM
------------	------	------	100	99	99	97	93	(8)	------	------	------	57	19	A-7-5(15)	OH
------------	------	------	100	99	98	97	95	89	75	42	23	43	15	A-7-6(11)	ML-CL
------------	------	------	------	100	99	98	95	89	76	64	44	47	22	A-7-6(14)	CL
------------	------	------	------	100	99	97	96	83	53	20	12	26	9	A-4(8)	CL
------------	100	93	86	68	59	47	31	(8)	------	------	------	28	5	A-2-4(0)	SM-SC
2	98	88	73	50	39	26	17	13	6	1	0	21	4	A-1-b(0)	GM
3	97	90	71	32	17	7	4	(9)	------	------	------	25	8	A-2-4(0)	GW
10	90	70	55	37	29	12	6	(9)	------	------	------	22	5	A-1-a(0)	GW-GC
2	100	87	65	33	22	8	3	(9)	------	------	------	------	NP	A-1-a(0)	GW
------------	------	100	96	92	90	84	71	(8)	------	------	------	40	13	A-6(8)	ML-CL
------------	100	95	93	88	85	78	67	59	42	26	17	27	9	A-4(6)	CL
------------	------	100	97	87	81	72	63	50	25	16	11	29	11	A-6(6)	CL
------------	100	97	94	83	77	66	53	42	18	10	4	22	8	A-4(4)	CL
------------	100	96	85	59	46	35	26	20	5	1	0	19	2	A-2-4(0)	GM
------------	100	99	96	92	89	84	75	(8)	------	------	------	39	12	A-6(9)	ML-CL
------------	------	100	98	93	89	83	73	60	32	15	7	24	6	A-4(8)	ML-CL
------------	------	------	100	99	95	89	80	69	43	21	13	24	7	A-4(8)	ML-CL
------------	100	94	78	54	45	35	32	28	21	11	7	29	11	A-2-6(0)	GC
------------	100	98	90	59	48	36	32	28	21	10	8	29	11	A-2-6(0)	GC

TABLE 4.—*Engineering*

Soil name and location	Parent material	Depth	Moisture density data [1]: Maximum dry density	Moisture density data [1]: Optimum moisture	In place moisture content [2]	In place dry density [3]	Lineal shrinkage	Reaction	Organic matter [4]	Percolation rate [5]
		In.	*Lb. per cu. ft.*	*Pct.*				*pH*		*Min./in.*
Erie silt loam:										
Town of Sheldon, 2 miles northwest of Varysburg, 0.25 mile north of U.S. Highway No. 20A on Maxon Road. (Modal)	Glacial till derived mainly from shale and siltstone and some limestone.	0–8	91	26	19	82	6. 4	6. 2	5. 2	--------
		8–16	115	14	8	102	3. 4	6. 1	1. 0	--------
		16–38	120	13	8	116	8. 0	6. 0	0. 5	>120
		38–65	127	10	11	119	4. 0	6. 5	------	>120
Town of Bennington: 1 mile east-southeast of Bennington Center on Graff Road, 0.25 mile south of State Route 354. (High shale content)	Glacial till derived mainly from shale and sandstone and some limestone.	0–8	88	29	26	76	8. 4	5. 4	4. 2	--------
		8–13	107	19	--------	--------	8. 0	5. 1	2. 0	--------
		13–25	106	19	14	103	8. 2	7. 3	0. 6	>120
		25–55	120	12	12	121	6. 0	7. 7	------	>120
Fremont silt loam:										
Town of Bennington, 1 mile west-southwest of Bennington Center on Borrough's Road. (Modal)	Acid glacial till derived mainly from silty shale.	0–7	77	37	35	65	10. 0	4. 6	5. 7	--------
		7–12	91	27	--------	--------	8. 2	4. 5	2. 3	--------
		12–19	86	31	29	80	8. 0	4. 8	1. 7	--------
		19–28	99	23	20	92	6. 2	4. 8	0. 8	>120
		28–45	116	14	12	123	7. 2	5. 5	------	>120
Town of Bennington, 1 mile west-southwest of Bennington Center on Borrough's Road. (Shallow side of range)	Acid glacial till derived mainly from silty shale.	0–6	81	34	27	67	8. 4	4. 7	6. 2	--------
		6–11	89	28	20	84	8. 0	4. 5	1. 8	>120
		11–20	106	19	17	92	6. 4	4. 8	0. 9	>120
		20–30	111	16	13	118	6. 0	7. 0	------	>120
Howard shaly silt loam:										
Town of Bennington, 2.3 miles north of Bennington Center on O'Connor Road on the Wyoming and Genesse County line.	Acid glacial outwash derived mainly from shale.	0–9	104	17	15	95	6. 0	5. 2	3. 7	--------
		9–21	106	19	18	94	7. 0	4. 8	1. 9	0. 9
		21–35	112	15	10	100	5. 4	4. 7	1. 8	0. 9
		35–55	123	12	16	112	2. 2	4. 5	------	0. 2
Langford channery silt loam:										
Town of Middlebury, 0.75 mile west of Dale on County Route 19.	Glacial till derived mainly from sandstone and shale and some limestone.	0–7	95	23	17	74	5. 8	5. 3	7. 2	--------
		7–20	103	18	10	81	4. 2	5. 3	2. 1	--------
		20–22	125	11	6	110	1. 2	5. 6	0. 6	21. 5
		22–27	--------	--------	--------	--------	--------	------	------	--------
		27–45	120	13	9	115	4. 0	6. 9	0. 5	--------
		45–55	124	11	11	122	4. 0	7. 3	------	>120
Williamson silt loam:										
Town of Sheldon, on U.S. Highway No. 20A, 0.9 mile east of State Route No. 77 intersection.	Lacustrine silts over layered silt clay, and very fine sand; acid.	0–9	85	32	27	71	4. 8	7. 7	3. 5	--------
		9–11	--------	--------	--------	--------	--------	------	------	--------
		11–22	100	23	17	93	2. 0	5. 4	1. 1	12. 0
		22–44	98	24	26	96	4. 4	4. 8	------	>120

[1] Based on the Moisture—density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop, AASHO Designation T 99, Method C.

[2] In accordance with A.S.T.M. Designation D2216–63T.

[3] Based on A.S.T.M. Designation D1556–64.

[4] Wet combustion method based on Cornell University agronomy test procedure modified by the Soil Mechanics Bureau.

[5] New York State Department of Health, Bulletin No. 1, Standard Percolation Test.

[6] Mechanical analysis according to AASHO Designation T 88. Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation

test d ata—Continued

Coarse fragments more than 3 inches discarded	Mechanical analysis [6]											Liquid limit	Plasticity index [7]	Classification	
	Percentage passing sieve—							Percentage smaller than—						AASHO	Unified
	3 in.	1½ in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
Pct.													Pct.		
------	100	93	88	83	78	72	60	(8)	------	------	------	40	11	A-6(5)	ML-CL
------	100	99	93	84	80	75	57	46	19	8	5	22	5	A-4(4)	ML-CL
------	100	95	88	77	72	65	54	46	27	12	8	22	7	A-4(4)	ML-CL
3	97	92	83	67	57	46	37	29	14	6	3	20	4	A-4(0)	GM
------	------	100	98	95	94	90	79	(8)	------	------	------	42	14	A-7-6(10)	ML-CL
------	------	100	98	97	95	90	77	65	42	21	13	31	7	A-4(8)	ML-CL
------	100	96	92	85	80	72	61	53	26	19	13	27	10	A-4(5)	CL
------	------	100	95	81	71	60	49	42	28	15	10	23	8	A-4(3)	SC
------	------	------	100	99	98	96	93	(8)	------	------	------	57	18	A-7-5(15)	MH
------	------	------	100	99	98	96	93	76	39	19	8	52	17	A-7-5(13)	MH
------	------	------	100	99	98	96	94	84	61	35	22	45	17	A-7-6(12)	ML-CL
------	------	------	------	100	96	90	84	72	49	23	15	32	11	A-6(8)	CL
------	------	------	100	93	73	55	50	40	18	9	4	30	11	A-6(3)	SC
------	------	------	------	100	99	95	90	(8)	------	------	------	54	16	A-7-5(13)	MH
------	------	------	------	100	99	96	91	81	59	34	21	43	15	A-7-6(11)	ML-CL
------	------	------	100	98	94	89	79	70	49	35	22	33	13	A-6(9)	CL
------	------	100	90	35	33	31	30	26	20	11	7	30	12	A-2-6(1)	GC
------	------	100	99	90	71	52	46	(8)	------	------	------	38	13	A-6(3)	SM-SC
------	------	100	97	69	54	37	32	28	20	11	7	35	11	A-2-6(0)	SM-SC
------	------	100	82	42	31	11	8	6	5	3	2	32	10	A-2-4(0)	GW-GC
------	100	92	60	37	29	16	7	5	2	1	1	------	NP	A-1-a(0)	GW-GC
------	100	98	91	83	76	65	48	(8)	------	------	------	42	11	A-7-5(3)	SM
------	100	94	88	75	69	59	46	42	35	15	7	29	9	A-4(2)	SC
6	94	88	83	69	63	53	33	28	15	7	4	17	2	A-2-4(0)	SM
10	90	84	80	69	62	53	43	40	37	16	11	21	7	A-4(2)	GM-GC
------	------	98	93	81	75	64	50	44	33	15	10	21	6	A-4(3)	SM-SC
------	------	------	------	100	99	95	88	(8)	------	------	------	41	8	A-5(8)	ML
------	------	------	------	100	100	99	94	83	57	14	7	------	NP	A-4(8)	ML
------	------	------	------	------	100	100	97	86	59	21	10	29	9	A-4(8)	CL

Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[7] NP=Nonplastic.

[8] No hydrometer analysis performed on soils containing considerable organic matter because of its flocculating effect.

[9] No hydrometer analysis performed on sand if less than 10 percent passing No. 200 sieve.

TABLE 5.—*Estimated soil*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of the table.

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface (typical profile)	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO
	Ft.	*Ft.*	*In.*			
Alden: Ad	3½–6	0	0–7	Mucky silt loam	CL or OL, ML or OL	A–7
			7–30	Silt loam	ML or CL	A–4
			30–50	Gravelly loam	SM or SC, ML or CL	A–4
Allard: AlA, AlB, AlC	3½–6	>3½	0–24	Silt loam	ML or CL	A–4 or A–6
			24–40	Very gravelly loamy sand	GM, GW or GP	A–1
Alluvial land: Am. Estimates not given because soil material is variable.						
*Angola: AnA, AoB. For Aurora part of unit AoB, see the Aurora series.	1½–3½	½	0–13	Shaly silt loam	ML or CL	A–4
			13–28	Shaly light silty clay loam	ML or CL	A–4
			28	Hard shale bedrock.		
Appleton: ApA, ApB	>3½	½	0–26	Gravelly silt loam or loam	ML or CL	A–4
			26–40	Gravelly heavy loam	SM or SC, ML or CL	A–4
			40–50	Gravelly loam	GM or GC, SM or SC, ML or CL	A–4 or A–2
Arkport: ArB, ArC, ArD, ArE	>6	>3½	0–21	Very fine sandy loam	SM	A–4
			21–46	Loamy very fine sand and very fine sandy loam.	SM or ML	A–4
			46–60	Stratified very fine sand, fine sand, and silt.		
Arnot: AtB, AtC	<1½	1–1½	0–8	Channery silt loam	SM or SC, ML or CL, GM or GC	A–4
			8–15	Very channery silt loam	GM	A–2 or A–4
			15	Hard sandstone bedrock.		
Aurora: AuC	1½–3½	>1½	0–15	Shaly silt loam	ML or CL	A–4
			15–31	Shaly silty clay loam to shaly silt loam.	ML or CL, GM or GC, SM or SC	A–4
			31	Brittle shale bedrock.		
*Bath: BaA, BaB, BaC, BaD, BaE, BlA, BlB, BlC, BlD. For Valois part of units BlA, BlB, BlC, and BlD, see the Valois series.	>3½	>2½	0–29	Channery silt loam to channery loam.	GM or GC or SM or SC	A–4, A–5, or A–2
			29–58	Channery loam fragipan to flaggy loam till.	GM or GC or SM	A–4, A–1, or A–2
Burdett: BuA, BuB	3½–6	½–1½	0–19	Silt loam	ML or CL	A–4
			19–27	Loam	ML or CL	A–4
			27–38	Silty clay loam	ML or CL	A–4
			38–50	Shaly silt loam	ML or CL, SM or SC	A–4
Canadice: Ca	<6	0	0–9	Silty clay loam	OH or OL or CL, ML, or CL	A–7
			9–14	Silty clay loam	ML or CL	A–4 or A–6
			14–50	Silty clay	CL	A–4 or A–6
Canaseraga: CcA, CcB, CcC	>6	1½–2½	0–21	Silt loam	ML or CL	A–4
			21–26	Very fine sandy loam	SM or ML	A–4
			26–52	Channery loam (fragipan)	SM or SC, ML or CL	A–4

properties significant to engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for The symbol < means less than, and the symbol > means more than]

Coarse fraction more than 3 inches discarded	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			
Pct.					*In./hr.*	*In./in. of soil*	*pH*
0-2	90-95	90-95	85-95	60-85	0.63-2.0	0.17-0.20	6.1-7.3
0-2	90-100	90-100	85-100	60-90	0.63-2.0	0.16-0.18	6.1-7.3
2-10	70-80	65-75	55-70	40-55	<0.2	----------	6.6-8.4
----------	95-100	95-100	85-100	65-90	0.63-2.0	0.17-0.20	4.5-5.5
2-10	35-45	30-40	15-30	5-15	>6.3	----------	5.1-7.3
----------	80-90	75-85	70-85	50-75	0.63-2.0	0.13-0.16	6.1-7.3
----------	60-75	55-70	50-70	50-65	<0.2	0.08-0.10	6.1-7.6+
0-5	80-90	75-85	70-85	55-70	0.63-2.0	0.10-0.16	5.6-7.3
0-5	75-85	70-80	60-75	45-60	<0.63	----------	6.1-7.8
5-15	60-85	55-80	40-75	30-60	<0.2	----------	7.4-8.4
----------	100	95-100	80-95	45-50	0.63-6.3	0.13-0.14	5.1-6.0
----------	100	100	90-95	40-60	>2.0	0.13	6.1-7.3
----------	----------	----------	----------	----------	>2.0	----------	>7.6
2-10	70-75	65-70	60-70	45-65	0.63-2.0	0.12-0.13	4.5-5.5
2-10	40-55	35-50	30-50	25-45	0.63-6.3	0.06-0.09	4.5-5.5
----------	80-90	75-85	70-85	50-75	0.63-2.0	0.13-0.16	6.0-7.3
----------	65-75	60-70	50-70	40-65	<0.2	0.09-0.10	6.0-7.6+
5-10	55-80	50-75	40-65	30-50	0.63-2.0	0.07-0.09	4.5-6.0
5-15	55-70	50-65	40-55	25-40	<0.2	----------	5.1-7.3
----------	95-100	95-100	85-100	65-90	0.63-2.0	0.17-0.20	5.6-6.5
----------	85-90	80-90	70-85	50-65	0.63-2.0	0.11-0.12	6.1-6.5
----------	70-80	65-75	60-75	55-70	<0.63	----------	6.6-7.3
----------	65-80	60-75	55-75	40-65	<0.2	----------	>7.6
----------	100	100	95-100	85-95	0.63-2.0	0.16	5.6-6.5
----------	100	100	95-100	85-95	0.2-0.63	0.15	6.1-6.5
----------	95-100	95-100	90-100	85-95	<0.2	0.12	6.1-7.6+
----------	95-100	95-100	90-100	65-90	0.63-2.0	0.17-0.20	4.5-5.5
----------	95-100	95-100	85-95	45-65	0.63-6.3	0.12-0.13	4.5-5.5
5-10	80-85	65-80	55-75	40-60	<0.2	----------	5.6-7.3

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface (typical profile)	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO
	Ft.	*Ft.*	*In.*			
Caneadea: CdA, CdB, CdC, CeD3, CeE3	>3½	1	0–8	Silt loam	ML or OH or OL	A–7
			8–19	Silty clay loam	ML or CL	A–7
			19–34	Silty clay	ML or CL	A–7
			34–40	Layers of silty clay loam, silty clay, and silt loam.	ML or CL	A–4 or A–6
Castile: CgA, CgB, ChA	>5	1½–2	0–34	Gravelly loam to very gravelly loam.	GM	A–1 or A–2 or A–4
			34–50	Stratified sand and gravel		
Chenango: ClA, ClB, ClC, ClD, CmB	>5	>3½	0–9	Gravelly loam	GM or GC, SM or SC	A–2 or A–6
			9–34	Very gravelly loam	GM or GC or GW or SM or SC	A–1 or A–2
			34–60	Stratified sand and gravel		
Churchville: CnB, CnC	>3½	½–1½	0–11	Silt loam	ML or CL	A–4
			11–30	Silty clay to silty clay loam.	ML or CL	A–4 or A–6
			30–45	Channery loam	GM or GC, SM or SC, ML or CL	A–2 or A–4
Collamer: CoB, CoC, CoD	>4	1½	0–14	Silt loam	ML or CL	A–4
			14–36	Heavy silt loam	ML or CL	A–4 or A–6
			36–60	Varved silt and very fine sand.		
Conesus: CrA, CrB, CrC	>3½	1½–2	0–9	Gravelly silt loam	ML or CL	A–4
			9–25	Loam	ML or CL	A–4
			25–36	Gravelly heavy silt loam	ML or CL	A–4
			36–50	Gravelly loam	SM, SC or ML	A–4
Dalton: DaA, DaB	>3½	½–1½	0–18	Silt loam	ML or CL	A–4, A–6
			18–70	Channery loam (fragipan and till).	SM or SC, ML or CL, GM or GC	A–2 or A–4
Danley: DeB, DeC, DlD3, DlE3	>3½	1½–2	0–12	Silt loam	ML or CL	A–4 or A–6
			12–36	Shaly silty clay loam to shaly clay loam.	ML or CL	A–4 or A–6
			36–50	Shaly silty clay loam	ML or CL	A–4 or A–6
Darien: DnA, DnB, DnC	>3½	½–1½	0–12	Silt loam	ML or CL	A–4
			12–35	Silty clay loam	ML or CL	A–4 or A–6
			35–50	Shaly silty clay loam	ML or CL	A–4 or A–6
Ellery: Ee	>3½	0–½	0–8	Silt loam	OL or CL, OL or ML	A–4 or A–6
			8–15	Silt loam	ML or CL	A–4
			15–50	Silt loam to gravelly silt loam (fragipan).	ML or CL	A–4
			50–60	Channery silt loam	ML or CL	A–4
Erie: ErA, EsB, EsC	>3½	½–1½	0–15	Channery silt loam	ML or CL	A–4, A–6, A–7
			15–45	Channery silt loam (fragipan).	SM or SC, ML or CL	A–4
			45–60	Channery loam	GM, GC, SM, SC	A–2 or A–4
*Fremont: FrA, FrB, FsC, FtD, FtE. For Hornell part of units FtD and FtE, see the Hornell series.	>3½	½–1½	0–9	Silt loam	MH or OH	A–7
			9–28	Light silty clay loam	ML or CL	A–6 or A–7
			28–50	Shaly silt loam	GM or GC, ML or CL, SM or SC	A–4 or A–6

properties significant to engineering—Continued

Coarse fraction more than 3 inches discarded	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			
Pct.					*In./hr.*	*In./in. of soil*	*pH*
	95–100	95–100	85–100	65–95	0.63–2.0	0.17–0.20	4.5–6.0
	95–100	95–100	90–100	75–95	<0.2	0.14–0.15	4.5–6.0
	95–100	95–100	90–100	85–95	<0.2	0.12	5.6–7.3
	95–100	95–100	85–100	65–95	<0.2		>7.6
0–5	30–65	25–60	20–55	15–35	2.0–6.3	0.03–0.08	4.5–5.5
0–10					>6.3		5.1–6.5
0–5	65–90	55–70	45–55	25–45	2.0–6.3	0.09–0.15	4.5–5.5
0–5	30–70	15–55	5–40	5–35	2.0–6.3	0.05–0.07	4.5–5.5
0–10					>6.3		5.1–5.5
	90–100	90–100	85–100	70–90	0.63–2.0	0.20	5.5–7.3
	85–100	80–100	70–100	65–95	<0.63	0.12–0.15	6.1–7.8
5–10	60–85	45–75	35–65	25–55	<0.2		>7.6
	100	100	90–100	70–85	0.63–2.0	0.18–0.20	5.6–6.5
	100	100	90–100	80–90	0.2–0.63	0.18	6.1–7.3
					<0.63		>7.6
0–5	80–90	75–85	70–85	60–70	0.63–2.0	0.13–0.16	5.6–6.5
0–5	85–95	80–90	70–85	50–65	0.63–2.0	0.11–0.12	5.6–6.5
5–10	75–85	70–80	65–80	50–65	<0.63	0.13–0.14	6.1–7.8
5–10	65–80	60–75	50–70	40–55	<0.2		>7.6
	90–100	90–100	80–100	65–90	0.63–2.0	0.17–0.20	4.5–6.5
5–10	55–75	45–70	35–65	30–55	<0.2		5.1–7.6
	95–100	85–95	75–95	60–85	0.63–2.0	0.15–0.18	5.1–6.5
	75–85	70–80	65–80	50–75	<0.63	0.08–0.12	6.1–7.3
	65–70	60–65	55–65	50–60	<0.2		>7.6
	90–100	80–95	70–95	55–85	0.63–2.0	0.14–0.18	5.5–6.5
	80–90	75–90	70–90	60–85	<0.2	0.11–0.13	6.1–7.6
	75–90	70–85	65–85	60–80	<0.2		>7.6
0–5	90–95	85–95	75–95	60–85	0.63–2.0	0.15–0.18	5.6–7.3
0–5	80–90	75–85	70–85	50–75	0.63–2.0	0.13–0.15	5.6–7.3
5–10	75–85	70–80	65–80	50–70	<0.2		6.1–7.3
5–15	80–90	75–85	70–85	50–75	<0.2		6.6–7.6
5–10	75–95	70–95	65–90	55–80	0.63–2.0	0.13–0.15	4.5–7.3
5–15	65–85	60–80	55–75	40–65	<0.2		4.5–7.3
5–15	45–80	40–70	35–60	30–50	<0.2		6.6–7.6
	95–100	95–100	85–100	85–95	0.63–2.0	0.17–0.20	4.5–5.5
	95–100	90–100	85–100	80–95	0.2–0.63	0.13–0.15	4.5–5.5
	60–95	55–75	50–65	40–60	<0.2		4.5–5.5

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Halsey: Ha	>4	0	0–8	Loam	OL or ML or CL	A–4
			8–28	Gravelly loam to gravelly sandy loam.	SM or SC, GM or GC, ML or CL	A–1 or A–2 or A–4
			28–50	Poorly stratified, very gravelly loamy sand.	GM or GW or GP	A–1
Hamlin: Hc	>6	[1] >2½	0–42	Silt loam	ML or CL	A–4
			42–61	Silt loam and strata of sandy loam in places.		
Herkimer: HeA, HeB	>6	2–2½	0–38	Shaly silt loam	OL or ML or CL, GM or GC, SM or SC	A–4 or A–7
			38–60	Stratified very shaly loam	GM or GC	A–2
*Homer: Hg, Hh. Properties of these units are the same, except that the unit Hh is underlain by clay and silty clay at a depth of 5 to 10 feet.	>4	½–1½	0–14	Gravelly loam	SM or SC, GM or GC	A–4 or A–5
			14–35	Gravelly loam	GM or GC	A–2 or A–4 or A–6
			35–55	Stratified sand and gravel		
Hornell: HIA, HIB, HIC	1½–3½	½–1½	0–20	Silty clay loam to silt loam	ML or CL	A–6
			20–30	Silty clay	ML or CL	A–6
			30	Soft shale bedrock.		
*Howard: HmA, HmB, HmC, HmD, HnA, HnB, HnC, HoB, HoC, HoD, HrB, HrC, HrD, HsE. For Madrid part of units HoB, HoC, HoD, HrB, HrC, and HrD, see the Madrid series. For Chenango part of unit HsE, see the Chenango series.	>6	>3½	0–36	Gravelly to very gravelly loam.	GM or GC	A–2 or A–4
			36–45	Very gravelly heavy loam	GM or GC, GW or GP	A–1
			45–70	Stratified sand and gravel		
Ilion: In	>3½	0	0–9	Silt loam	OL or ML or CL	A–4 or A–7
			9–14	Silt loam	OL or ML or CL	A–4
			14–33	Light silty clay loam	ML or CL	A–4
			33–50	Shaly silt loam	ML or CL	A–4
Langford: LaA, LaB, LaC, LaD	>3½	1½–2	0–20	Channery silt loam	SM or SC	A–4
			20–55	Channery silt loam (fragipan).	SM or SC, GM or GC	A–4 or A–2
Lansing: LgB, LgC, LgD, LgE	>3½	>2½	0–21	Gravelly silt loam	ML or CL	A–4
			21–39	Gravelly silt loam	ML or CL	A–4
			39–50	Gravelly loam	GM or GC	A–2 or A–4
Lordstown: LoB, LoC, LoD, LoE	1½–3½	>2	0–15	Channery silt loam	GM or GC	A–2 or A–4
			15–28	Very channery loam	GM or GC	A–2
			28	Hard sandstone bedrock.		
Lyons: Ly	>3½	0	0–9	Silt loam	OL or ML or CL	A–4 or A–7
			9–28	Silt loam	ML or CL	A–4
			28–50	Gravelly loam	SM or SC, ML or CL	A–4

See footnote at end of table.

properties significant to engineering—Continued

Coarse fraction more than 3 inches discarded	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			
Pct.					*In./hr.*	*In./in. of soil*	*pH*
0–3	80–90	75–85	70–85	50–70	0.63–6.3	0.11–0.13	5.6–7.3
5–10	60–70	55–65	40–65	20–55	>2.0	0.08–0.09	5.6–7.3
5–10	35–45	30–40	20–35	0–15	>6.3	----	5.6–7.6+
----	100	100	90–100	60–85	0.63–2.0	0.18–0.20	6.1–7.3
----	----	----	----	----	>0.63	----	7.4–7.8
0–3	55–80	50–75	45–75	40–60	0.63–6.3	0.09–0.10	5.6–7.3
0–5	25–35	20–30	20–30	15–25	>6.3	----	6.5–7.6+
0–5	65–70	60–65	50–60	40–45	0.63–2.0	0.08–0.09	5.6–7.3
0–5	55–65	50–60	45–55	30–45	0.2–2.0	0.07–0.08	6.0–7.8
----	----	----	----	----	>6.3	----	>7.6
----	85–95	80–90	70–90	65–80	<0.63	0.12–0.17	4.5–5.5
----	80–90	75–85	70–85	65–80	<0.2	----	4.5–5.5
5–10	55–65	45–60	40–55	30–40	0.63–6.3	0.07–0.09	5.1–6.0
5–15	25–40	20–35	15–35	10–20	0.63–6.3	0.03–0.05	6.1–7.8
----	----	----	----	----	>6.3	----	>7.6
----	90–100	85–100	75–100	60–85	0.63–2.0	0.16–0.20	6.1–7.3
----	85–95	80–90	70–90	55–75	0.63–2.0	0.14–0.16	6.1–7.3
----	80–90	75–85	70–85	65–75	<0.2	0.11–0.12	6.6–7.8
----	70–85	65–80	60–80	50–70	<0.2	----	7.3–7.6+
5–15	65–85	60–75	55–75	40–50	0.63–2.0	0.11–0.14	5.1–7.3
10–20	70–80	50–75	45–75	30–50	<0.2	----	5.1–7.6+
0–10	80–90	75–85	70–85	60–70	0.63–2.0	0.13–0.16	5.1–6.0
0–10	75–85	70–80	65–80	50–65	0.63–2.0	0.13–0.14	6.1–7.3
5–15	45–70	40–65	35–60	25–50	<0.63	----	>7.6
5–10	55–65	50–60	45–60	30–50	0.63–2.0	0.09–0.12	5.1–5.5
5–15	45–55	40–50	35–45	25–35	0.63–2.0	0.07–0.09	5.1–5.5
0–5	90–100	90–100	80–100	65–85	0.63–2.0	0.17–0.20	6.1–7.3
0–10	85–95	80–90	70–90	60–80	0.63–2.0	0.14–0.16	6.1–7.3
5–15	75–85	70–80	60–75	45–60	<0.2	----	7.3–7.6+

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to— Bedrock	Seasonal high water table	Depth from surface (typical profile)	Classification: Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Madrid: MaB, MaC, MdB, MdC	>6	>3	0–19	Loam	ML or CL	A–4
			19–47	Very fine sandy loam to loam.	SM or SC, ML or CL	A–4
			47–59	Gravelly loam	SM or SC, ML or CL	A–4
			59–75	Gravelly loam or gravelly very fine sandy loam.	GM or GC, SM, SC or ML	A–2 or A–4
Manlius: MlB, MlC, MlD, MlE, MnF	1½–3½	>2	0–30	Very shaly silt loam or loam.	GM or GC	A–2 or A–4
			30	Brittle shale bedrock.		
Mardin: MrA, MrB, MrC, MrD	3½–6	1–2	0–16	Channery silt loam or channery loam.	SM or SC, ML or CL	A–4
			16–28	Channery loam (fragipan)	SM or SC, ML or CL	A–4
			28–70	Very channery loam (fragipan).	GM or GC	A–2 or A–4
Marilla: MsB, MsC	>3½	1–2	0–18	Shaly silt loam	ML or CL	A–5 or A–6 or A–7
			18–60	Very shaly loam (fragipan)	GM or GC	A–1 or A–2
Niagara: Ng	>6	1	0–13	Silt loam	OL or ML or CL	A–4 or A–6
			13–36	Heavy silt loam to light silty clay loam.	ML or CL	A–4
			36–50	Silt loam and some very fine sandy strata.	ML or CL	A–4
Nunda: NuB, NuC, NuD	>6	1½–2½	0–27	Silt loam	ML or CL	A–4
			27–42	Silty clay loam	ML or CL	A–4
			42–50	Shaly silt loam	ML or CL, GM or GC	A–4
Palms muck: Pa. Estimates not given because soil material is variable.						
Palmyra: PgA, PgB	>6	>3½	0–12	Gravelly loam	SM or SC, GM or GC	A–2 or A–4
			12–29	Gravelly loam	SM or SC, GM or GC	A–2 or A–4
			29–50	Very gravelly sandy loam becoming stratified sand and gravel.		
Papakating: Pk, Pm	>6	[1] 0–½	0–8	Mucky silt loam	OL or ML or CL	A–4 or A–6
			8–40	Silt loam	OL, ML, or CL	A–4 or A–6
			40–60	Very gravelly loamy sand	GW or GP, GM or GC	A–1
Phelps: PpA, PpB	>6	1½	0–16	Gravelly loam	SM or SC, GM or GC	A–2 or A–4
			16–36	Gravelly loam or gravelly sandy loam.	SM or SC, GM or GC	A–1 or A–2 or A–4
			36–50	Stratified very gravelly sand.	GM or GC, GW or GP	A–1

See footnote at end of table.

properties significant to engineering—Continued

Coarse fraction more than 3 inches discarded	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction
Pct.					*In./hr.*	*In./in. of soil*	*pH*
0–10	90–95	85–90	70–85	50–65	0.63–2.0	0.11–0.13	5.1–7.3
0–10	90–95	80–90	70–85	45–65	0.63–2.0	0.11–0.13	5.1–6.5
5–10	75–85	70–80	60–75	40–55	0.63–2.0	0.09–0.11	6.1–7.3
5–15	55–85	50–80	45–75	25–55	0.63–6.3	----------	7.4–7.6+
----------	40–50	35–45	30–45	25–45	0.63–2.0	0.06–0.13	4.5–5.5
5–10	80–90	70–85	60–85	40–65	0.63–2.0	0.10–0.16	4.5–5.5
5–15	75–85	70–80	60–75	40–60	<0.2	----------	4.5–5.5
5–15	60–70	55–65	45–60	30–50	<0.2	----------	4.5–7.6
0–2	65–75	60–70	55–70	55–65	0.63–2.0	0.11–0.13	4.5–5.5
0–2	35–55	30–50	25–45	20–35	<0.2	----------	4.5–6.0
----------	100	100	90–100	70–85	0.63–2.0	0.18–0.20	5.6–7.3
----------	100	100	90–100	75–90	0.2–0.63	0.18	6.1–7.8
----------	100	100	85–100	70–90	<0.63	----------	>7.6
----------	90–100	90–100	80–100	65–80	0.63–2.0	0.17–0.20	5.6–6.5
----------	80–90	75–85	70–85	65–80	0.2–0.63	0.11–0.13	6.1–7.8
0–2	65–75	60–70	55–70	45–60	<0.2	----------	7.3–7.6+
0–5	65–70	60–65	50–60	30–45	0.63–6.3	0.08–0.09	6.0–7.3
0–10	55–70	50–65	45–60	30–50	0.63–6.3	0.07–0.09	6.5–7.6
5–15	----------	----------	----------	----------	>6.3	----------	>7.6
----------	100	100	90–100	80–90	0.63–2.0	0.20	5.6–6.5
----------	100	100	90–100	80–90	0.2–2.0	0.18	5.6–6.5
0–10	45–55	40–50	20–40	5–15	>6.3	----------	5.6–6.5
0–5	65–75	60–70	50–65	30–50	0.63–2.0	0.08–0.10	5.6–7.3
0–5	55–65	50–60	30–55	20–40	0.63–2.0	0.07–0.08	6.1–7.8
5–15	25–55	20–50	10–35	0–10	>2.0	----------	>7.6

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface (typical profile)	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO
	Ft.	*Ft.*	*In.*			
Red Hook: Rh	>6	½–1½	0–28	Gravelly loam or gravelly sandy loam.	SM or SC, GM or GC	A-2 or A-4
			28–50	Very gravelly loamy sand	GW or GP, SM or SC	A-1
Rock outcrop: Ro. Estimates not given because soil material is variable.						
Scio: ScA, ScB	>6	1½–2	0–40	Silt loam	ML or CL	A-3
			40–50	Gravelly loamy sand	SM or GM	A-1 or A-2
Sun: Su	>3½	0–½	0–9	Silt loam	OL, ML, or CL	A-4 or A-7
			9–21	Very fine sandy loam	ML or CL	A-4
			21–50	Gravelly loam	SM or SC, ML or CL	A-4
Teel: Te	>6	[1] 1½–2	0–60	Silt loam	OL or ML or CL	A-4 or A-6
Tioga: Tg	>6	[1] >2	0–42	Silt loam	OL or ML or CL	A-4 or A-6
			42–50	Stratified very gravelly loamy sand.	GM or GC, GW or GP	A-1
Tuller: TuA, TuB	<1½	0–1	0–8	Channery silt loam	OL, ML or CL	A-4 or A-7
			8–17	Channery silt loam	SM or SC, GM or GC, ML or CL	A-2 or A-4
			17	Hard sandstone bedrock.		
Valois	>3½	>3½	0–45	Gravelly loam	SM or SC, GM or GC.	A-2 or A-4
Mapped only in a complex with Bath soils.			45–70	Gravelly sandy loam and very gravelly sandy loam.	SM or GM, GW or GP, SW or SP	A-1
Varysburg: VaB, VaC, VaD	>6	1½–2½	0–17	Gravelly loam	SM or SC, GM or GC	A-2 or A-4
			17–29	Very gravelly loam	GM or GC	A-1 or A-2 or A-4
			29–43	Silty clay	ML or CL	A-4 or A-6
			43–60	Silty clay loam and silt loam.	ML or CL	A-4 or A-6
Volusia: VoA, VoB, VoC	>3½	½–1½	0–14	Channery silt loam or channery loam.	OH or MH, ML or CL	A-7
			14–50	Channery loam (fragipan).	GM or GC, ML or CL	A-4 or A-6
Wallington: Wa	>6	½–1½	0–14	Silt loam	OL, ML, or CL	A-4 or A-7
			14–46	Silt loam (fragipan)	ML or CL	A-4
			46–60	Light silt loam and thin strata of loamy very fine sand.	ML or CL	A-4
Wallkill: Wk	>6	[1] 0–½	0–27	Silt loam	OL, ML, or CL	A-7
			27–50	Muck.		
Wayland: Wn	>6	[1] 0–1	0–8	Silt loam	OL or ML or CL	A-7
			8–43	Silt loam	ML or CL	A-4 or A-6
			43–50	Stratified silt loam and very fine sandy loam.	ML or CL	A-4 or A-6

See footnote at end of table.

properties significant to engineering—Continued

Coarse fraction more than 3 inches discarded	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			
Pct.					*In./hr.*	*In./in. of soil*	*pH*
0-5	65-75	60-70	50-65	30-50	0.63-6.3	0.08-0.10	4.5-5.5
5-15	45-55	40-50	25-35	5-20	>6.3	----------	4.5-5.5
----------	95-100	95-100	85-100	65-80	0.63-2.0	0.17-0.20	4.5-5.5
5-10	55-65	50-60	30-40	15-25	>6.3	----------	5.1-6.0
0-2	90-100	90-100	80-100	65-80	0.63-2.0	0.20	5.6-7.3
0-5	90-100	90-100	75-95	55-65	0.63-2.0	0.12-0.18	5.6-7.3
5-10	70-85	65-80	55-75	40-60	<0.63	----------	6.6-7.6+
----------	100	100	90-100	70-80	0.63-2.0	0.18-0.20	6.1-7.8
----------	100	100	90-100	70-80	0.63-2.0	0.18-0.20	5.1-6.0
5-15	40-50	35-45	20-35	5-15	>6.3	----------	6.1-7.3
0-5	70-75	65-70	60-70	45-55	0.63-2.0	0.12-0.14	4.5-5.5
2-10	50-60	45-55	40-55	30-50	0.63-2.0	0.07-0.13	4.5-5.5
2-10	65-75	60-70	50-65	30-50	0.63-6.3	0.08-0.10	4.5-5.5
5-15	30-65	25-60	15-40	5-25	>6.3	----------	5.1-7.3
0-5	60-70	55-65	45-60	30-50	0.63-6.3	0.07-0.09	5.1-6.0
2-10	35-65	30-60	25-55	15-40	2.0-6.3	0.04-0.08	5.6-7.3
----------	100	100	95-100	90-95	<0.2	----------	6.1-7.8
----------	100	100	95-100	90-100	<0.2	----------	>7.6
5-10	75-90	70-85	60-85	55-75	0.63-2.0	0.13-0.16	5.1-6.0
5-15	60-75	55-70	45-65	45-55	<0.2	----------	5.1-6.5
----------	100	100	90-100	70-80	0.63-2.0	0.18-0.20	4.5-6.0
----------	100	100	90-100	80-95	<0.63	----------	4.5-5.5
----------	100	100	90-100	70-90	<0.63	----------	5.1-6.5
----------	100	100	90-100	70-90	0.63-2.0	0.18-0.20	6.1-7.3
----------	100	100	90-100	70-90	0.63-2.0	0.20	6.6-7.8
----------	100	100	90-100	75-90	0.2-2.0	0.18	6.5-7.8
----------	100	100	90-100	60-80	0.2-2.0	----------	6.6-7.8

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Williamson:						
WoB, WoC	>6	1½–2	0–17	Silt loam	ML or CL	A–4
			17–41	Silt loam (fragipan)	ML or CL	A–4
			41–50	Strata of silt, very fine sand, and clay (silt dominant).		
WsB, WsC	>6	1½–2	0–24	Channery silt loam or channery loam.	SM or SC, GM or GC, ML or CL	A–2, A–4
			24–45	Silt loam	ML or CL	A–4
			45–60	Strata of silt and very fine sand.		

[1] Subject to flooding.

properties significant to engineering—Continued

Coarse fraction more than 3 inches discarded	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			
Pct.					*In./hr.*	*In./in. of soil*	*pH*
----------	100	100	90–100	80–90	0. 63–2. 0	0. 18–0. 20	4. 5–6. 0
----------	100	100	90–100	70–95	<0. 63	----------	5. 1–6. 5
----------	----------	----------	----------	----------	<0. 63	----------	5. 1–6. 5
0–5	55–90	50–85	45–85	30–70	0. 63–2. 0	0. 08–0. 17	4. 5–6. 0
----------	95–100	95–100	85–100	55–90	<0. 63	----------	4. 5–6. 0
----------	----------	----------	----------	----------	<0. 63	----------	5. 1–6. 5

TABLE 6.—*Interpretations*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The soils for referring to other series that

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Alden: Ad	Fair in top 30 inches; wet in natural state in places; adverse number of roots and stones in places.	Unsuitable	Poor in surface layer and subsoil; good in till substratum; wet in places.	Prolonged high water table at surface; depressional relief; cut slopes subject to seepage and sloughing; poor trafficability.	Generally adequate strength for high fills.
Allard: AlA, AlB, AlC	Good to depth of about 2 feet.	Unsuitable in silty surface layer and subsoil; good to fair in substratum.	Poor in silty surface layer and subsoil; good in gravelly substratum; underwater excavation problems in places.	Variable stability; cut slopes highly erodible; light cuts and fills involve nonuniform subgrade; soils subject to differential frost heave; fair trafficability in silty parts; deep cuts reach water table in places.	Generally adequate strength for moderately high embankments.
Alluvial land: Am	Variable: wet in places.	Unsuitable in places.	Extremely variable; excavations below water table in places.	Frequent flooding; high water table; variable subgrade soils.	Variable strength.
Angola: AnA	Poor: shaly and in places clayey.	Unsuitable	Poor to fair: generally low yield; 20 to 40 inches over shale bedrock; wet in places.	Seasonal high water table at depth of 6 inches; 20 to 40 inches deep over shale bedrock; cuts encounter rock and are subject to seepage and differential frost heave; poor trafficability when wet.	Adequate strength for high embankments.
Angola and Aurora: [1] AoB	Poor: shaly and in places clayey.	Unsuitable	Poor to fair: low yield; 20 to 40 inches deep over shale bedrock; wet in places.	Seasonal high water table at depth of 6 to 18 inches; 20 to 40 inches deep over shale bedrock; rock in cuts; seepage causes differential frost heave in places; poor trafficability when wet.	Adequate strength for high embankments.

See footnote at end of table.

of engineering properties

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of the table]

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength; prolonged high water table at surface.	Moderate permeability in subsoil, slow in substratum; prolonged high water table at surface; depressional relief.	High content of organic matter in surface layer; poor stability and compaction characteristics in subsoil; subject to piping; slow permeability in substratum when compacted.	Prolonged high water table at surface; slow permeability below depth of 30 inches; cut slopes subject to seepage and sloughing; depressional relief.	Generally not irrigated; very poorly drained.	Depressional relief.	Depressional relief; very poorly drained.
Generally adequate strength; water table in deep excavations in places. AIC: moderate slope.	Pervious material. AIC: moderate slope.	Unstable in silty surface layer and subsoil; subject to piping; pervious material in gravelly substratum; good for outside shell.	Generally not needed; well drained.	Moderate water intake rate; moderate to high available water capacity; no rooting depth restrictions; highly erodible. AIC: moderate slope.	AIB and AIC, complex slopes; gravelly and sandy below depth of about 2 feet; highly erodible in silty surface layer and subsoil.	Unstable in silty surface layer and subsoil; highly erodible; rapid permeability in gravelly substratum; well drained.
Frequent flooding; high water table.	Variable permeability; frequent flooding.	Variable material; wet in places.	Frequent flooding; variable permeability, texture, and water table; outlets inadequate in places.	Not applicable; frequent flooding.	Not applicable; nearly level; frequent flooding.	Frequent flooding; variable texture and drainage.
Adequate strength; seasonal high water table at depth of 6 inches; shale bedrock at depth of 20 to 40 inches.	Shale bedrock at depth of 20 to 40 inches.	Good stability above bedrock; low yield per acre.	Seasonal high water table at depth of 6 inches; shale bedrock at depth of 20 to 40 inches; slow permeability.	Not applicable; somewhat poorly drained.	Not applicable; nearly level.	Subject to seepage and prolonged flow; somewhat poorly drained; shale bedrock at depth of 20 to 40 inches.
Adequate strength; seasonal high water table at depth of 6 to 18 inches; shale bedrock in excavations at depth of 20 to 40 inches.	Shale bedrock at depth of 20 to 40 inches.	Good stability above bedrock; low yield per acre.	Seasonal high water table at depth of 6 to 18 inches; 20 to 40 inches deep over shale bedrock; moderately slow or slow permeability.	Slow water intake rate; moderate available water capacity; seasonal high water table at depth of 6 to 18 inches; variable rooting depths.	Shale bedrock at depth of 20 to 40 inches; subject to seepage; moderately slow or slow permeability.	Subject to seepage and prolonged flow; somewhat poorly drained and moderately well drained; shale bedrock at depth of 20 to 40 inches.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Appleton: ApA, ApB	Poor: gravelly.	Unsuitable	Good: wet in places; some large stones.	Seasonal high water table at depth of 6 inches; cut slopes subject to seepage and sloughing; fair to poor trafficability when wet.	Generally adequate strength for high embankments.
Arkport: ArB, ArC, ArD, ArE.	Fair to poor in top 21 inches; low fertility and moisture capacity.	Fair to poor for sand; too fine in places.	Poor: highly erodible by wind and water.	Cut slopes subject to severe erosion; deep cuts reach soft, wet, flowing material in places. ArD, ArE: moderately steep and steep; subgrade subject to differential frost heave.	Generally adequate strength for moderately high embankments. ArD, ArE: moderately steep and steep.
Arnot: AtB, AtC	Unsuitable: stony.	Unsuitable	Good material, but low yield; less than 20 inches deep over sandstone or siltstone; many stones in places.	Cuts encounter bedrock; seepage at soil and rock contact; subject to differential frost heave in places.	Adequate strength for high embankments.
Aurora: AuC	Poor: shaly and in places clayey.	Unsuitable	Poor to fair: low yield; 20 to 40 inches deep over shale bedrock.	Seasonal high water table at depth of 18 inches; 20 to 40 inches deep over shale bedrock; rock in most cuts; seepage causes differential frost heave in places; poor trafficability when wet.	Adequate strength for high embankments.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Seasonal high water table at depth of 6 inches; generally adequate strength.	Moderately slow or slow permeability below depth of about 26 inches; seasonal high water table at depth of 6 inches.	Good stability; slow permeability; some large stones.	Moderately slow or slow permeability below depth of about 26 inches; seasonal high water table at depth of 6 inches; ditchbanks subject to seepage and sloughing.	Moderate to slow water intake rate; rooting depth mainly in top 15 to 18 inches; seasonal high water table at depth of 6 inches; moderate available water capacity.	Moderately slow or slow permeability below depth of about 26 inches; subject to prolonged flow.	Ditchbanks subject to seepage and sloughing; subject to prolonged flow; somewhat poorly drained.
Generally adequate strength; sands compressible under vibratory loads. ArC, ArD, ArE: adverse relief.	Rapid permeability. ArC, ArD, ArE: adverse relief.	Poor stability; highly erodible; subject to piping.	Not applicable: well drained.	Rapid water intake rate; unrestricted rooting depth; moderate available water capacity; highly erodible. ArC, ArD, ArE: adverse slopes.	Complex short slopes; rapid permeability. ArD, ArE: moderately steep and steep slopes.	Highly erodible; rapid permeability; well drained. ArD, AeE: moderately steep and steep slopes.
Adequate strength; bedrock in excavations at depth of less than 20 inches.	Not applicable; less than 20 inches deep over bedrock.	Less than 20 inches deep over bedrock; low yield; many stones in places.	Generally not applicable; less than 20 inches deep over bedrock.	Moderate water intake rate; low available water capacity; less than 20 inches deep over bedrock.	Not applicable; less than 20 inches deep over bedrock.	Less than 20 inches deep over bedrock; well drained to moderately well drained.
Adequate strength; seasonal high water table at depth of 18 inches; shale bedrock in excavations at depth of 20 to 40 inches.	Shale bedrock at depth of 20 to 40 inches; 8 to 15 percent slopes.	Good stability above bedrock; low yield.	Seasonal high water table at depth of 18 inches; slow permeability; 8 to 15 percent slopes.	Slow water intake rate; moderate available water capacity: seasonal high water table at depth of 18 inches; variable rooting depth; 8 to 15 percent slopes.	Shale bedrock at depth of 20 to 40 inches; subject to seepage; slow permeability.	Subject to seepage; moderately well drained; shale bedrock at depth of 20 to 40 inches.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
*Bath: BaA, BaB, BaC, BaD, BaE, BlA, BlB, BlC, BlD. For Valois part of BlA BlB, BlC, and BlD, see the Valois series.	Poor: stony	Unsuitable	Good, but contains large stones.	Cut slopes subject to seepage and sloughing in places; generally good subgrade in cuts. BaD, BaE: moderately steep and steep. BlD: moderately steep; generally good trafficability except on soils that have steeper slopes.	Generally adequate strength for high embankments. BaD, BaE: moderately steep and steep. BlD: moderately steep.
Burdett: BuA, BuB	Fair to good surface layer; shale fragments in places.	Unsuitable	Poor in silty surface layer and upper part of subsoil; highly erodible; good in lower part of subsoil and underlying till.	Seasonal high water table at depth of 6 to 18 inches; cut slopes subject to severe seepage and sloughing; shallow cuts and light fills provide nonuniform soil and subgrade conditions; subgrade generally good in underlying till; poor trafficability when wet.	Generally adequate strength for moderately high embankments.
Canadice: Ca	Poor: clayey	Unsuitable	Poor: clayey; highly plastic.	Frequently ponded; prolonged high water table; cut slopes very unstable; subgrade in cuts is wet, soft silt and clay; generally poor trafficability.	Variable strengths.
Canaseraga: CcA, CcB, CcC.	Good to depth of about 21 inches in silty surface layer and upper part of subsoil.	Unsuitable	Poor in silty surface layer and upper part of subsoil; highly erodible; good in underlying till but contains some large stones.	Seasonal high water table at depth of 18 to 30 inches; skim cuts and fills provide nonuniform soil and subgrade conditions in places; seepage common above fragipan; cuts subject to differential frost heave; poor trafficability on silty surface material.	Generally adequate strength for high fills.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds: Reservoir	Farm ponds: Embankment	Agricultural drainage	Irrigation	Diversions	Waterways
Generally adequate strength; BaD, BaE: moderately steep and steep. BlD: moderately steep.	Slowly permeable fragipan at depth of 18 to 34 inches. BaC, BaD, BaE: moderate to steep slopes. BlC, BlD: moderately sloping and moderately steep.	Good stability; slow permeability when compacted; many large stones.	Generally not applicable; well drained.	Moderate water intake rate; moderate available water capacity; rooting depth ranges from 18 to 34 inches. BaC, BaD, BaE: moderately sloping to steep. BlC, BlD: moderately sloping to moderately steep.	Slowly permeable fragipan at depth of 18 to 34 inches. BaD, BaE: moderately steep and steep. BlD: moderately sloping to moderately steep.	Slowly permeable fragipan at depth of 18 to 34 inches; seepage above pan in places. BaD, BaE: moderately steep and steep. BlD: moderately steep; well drained.
Generally adequate strength; seasonal high water table at depth of 6 to 18 inches.	Moderately slow or slow permeability below depth of about 27 inches; seasonal high water table at depth of 6 to 18 inches.	Poor in silty surface layer and upper part of subsoil; highly erodible; subject to piping; fair to good stability in underlying till; slow permeability when compacted.	Moderately slow or slow permeability below depth of about 27 inches; ditchbanks unstable and subject to seepage and sloughing; seasonal high water table at depth of 6 to 18 inches.	Moderate to slow water intake rate; seasonal high water table at depth of 6 to 18 inches; restricted rooting depth; moderate available water capacity.	Highly erodible silty surface layer and upper subsoil; slow or moderately slow permeability below depth of about 27 inches.	Subject to prolonged flow; highly erodible in silty surface layer and upper subsoil; somewhat poorly drained.
Prolonged high water table and some ponding; low strength.	Prolonged high water table; ponding; slow permeability.	Poor stability and workability; subject to shrink-swell problems.	Prolonged high water table; ponding; slow permeability; outlets generally inadequate.	Prolonged high water table; ponding; generally not applicable.	Adverse relief___	Adverse relief; poorly drained.
Generally adequate strength; seasonal high water table at depth of 18 to 30 inches.	Slow permeability below depth of about 18 to 30 inches; seasonal high water table at depth of 18 to 30 inches. CcC: moderately sloping.	Highly erodible in silty surface layer and upper part of subsoil; subject to piping; stable underlying fragipan and till; slow permeability when compacted, but contains some large stones.	Slowly permeable fragipan at depth of about 18 to 30 inches; seasonal high water table at depth of 18 to 30 inches; unstable ditchbanks. CcC: moderately sloping.	Moderate to slow water intake rate; high available water capability; rooting depth restricted to zone above fragipan; seasonal high water table at depth of 18 to 30 inches. CcC: moderately sloping.	Slowly permeable fragipan at depth of about 18 to 30 inches; susceptible to erosion and siltation.	Highly erodible; siltation problems; moderately well drained to well drained; seepage above pan.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Caneadea: CdA, CdB, CdC, CeD3, CeE3.	Poor to fair: generally clayey. CeD3, CeE3: unsuitable.	Unsuitable	Poor: erodible; low shear strength; moderate shrink-swell potential.	Seasonal high water table at depth of 12 inches; severe seepage; cuts subject to sloughing and erosion; very poor subgrade conditions. CeD3, CeE3: parallel slope alignments for highway grade locations need to be avoided; poor trafficability when wet; adverse relief.	CdA, CdB, CdC: generally adequate strength for light fills. CeD3, CeE3: generally adequate strength for light fills, but need shear keys and berms in places.
Castile: CgA, CgB, ChA	Poor: gravelly or channery.	CgA: CgB, generally good. ChA: fan material shaly.	Good	Seasonal high water table at depth of 18 to 24 inches; some seepage in cuts; generally good subgrade in cuts; subject to severe differential frost heave; generally good trafficability. ChA: fans subject to flash flooding in places.	Generally adequate strength for moderately high embankments; underlain by weaker soils in places. ChA: generally adequate strength for low embankments in fan materials; commonly underlain by weaker soils in main valleys.
Chenango: ClA, ClB, ClC, ClD, CmB.	Poor: gravelly or channery.	Good. CmB: poor fan materials; high shale content.	Good	Some seepage in deep cuts in places; generally good subgrade in cuts; subject to severe differential frost heave. ClD: moderately steep; complex short slopes in places. ClC: complex short slopes in places; generally good trafficability, except where slopes are steeper.	Generally adequate strength for moderately high embankments; underlain by weaker soils in places. ClD: moderately steep.
Churchville: CnB, CnC	Fair in top 12 inches; clayey in places.	Unsuitable	Poor in lacustrine cap between depths of 20 to 36 inches; clayey and in places wet; generally good in underlying till; some large stones and in places wet; bedrock below depth of 48 inches in places.	Seasonal high water table at depth of 6 to 18 inches; nonuniform soil and subgrade conditions in cuts; cut slopes subject to seepage and sloughing; poor trafficability.	Generally adequate strength for moderately high embankments.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds: Reservoir	Farm ponds: Embankment	Agricultural drainage	Irrigation	Diversions	Waterways
Variable, but generally low strength; severe settlements occur under heavy loads in places; seasonal high water table at depth of 12 inches. CeD3, CeE3: adverse relief; low strengths.	Slow permeability below surface; seasonal high water table at depth of 12 inches. CeC, CeD3, CeE3: adverse slopes.	Poor stability; poor workability when wet; low shear strength; moderate shrink-swell potential.	Slow permeability below seasonal high water table at depth of 12 inches; unstable ditchbanks; CeC, CeD3, CeE3: adverse slopes.	Seasonal high water table at depth of 12 inches; generally not applicable. CeC, CeD3, CeE3: adverse slopes.	Poor workability when wet; slow permeability below surface. CeD3, CeE3: adverse slopes.	Dense clayey subsoil; seepy areas. CeD3, CeE3: adverse slopes; somewhat poorly drained to moderately well drained.
Generally adequate strength; seasonal high water table at depth of 18 to 24 inches; compressible under vibratory loads. ChA: fans subject to flash flooding in places.	Moderately rapid or rapid permeability; seasonal high water table at depth of 18 to 24 inches.	Good stability and shear strength; pervious material; good for outside shell.	Moderately rapid or rapid permeability; seasonal high water table at depth of 18 to 24 inches; sandy layers subject to piping. ChA: fans subject to flash flooding in places.	Moderate to rapid water intake rate; low available water capacity; seasonal high water table at depth of 18 to 24 inches; rooting depth at 24 inches or more.	Pervious material; very gravelly; low fertility.	Pervious material; moderately deep to stratified sand and gravel; low fertility; moderately well drained.
Generally adequate strength; compressible under vibratory loads; deep excavation reaches water table in places. ClD: moderately steep.	Pervious material..	Good stability and shear strength; pervious material; good for outside shell.	Generally not applicable.	Rapid water intake rate; low available water capacity; unrestricted rooting depth. ClC, ClD: adverse slopes.	Pervious material very gravelly; low fertility.	Pervious material; moderately deep to stratified sand and gravel; low fertility. ClD: adverse slope. ClC: complex short slopes in places; well drained.
Generally adequate strength and low compressibility; seasonal high water table at depth of 6 to 18 inches.	Slow or moderately slow permeability in lower subsoil; slow permeability in substratum; seasonal high water table at depth of 6 to 18 inches.	Clayey material in lacustrine cap between depths of 20 to 36 inches; poor compaction characteristics; moderate shrink-swell potential; stable underlying till; slow permeability when compacted; some large stones.	Moderately slow or slow permeability in subsoil; slow permeability in substratum; seasonal high water table at depth of 6 to 18 inches; unstable ditchbanks.	Slow water intake rate; moderate available water capacity; seasonal high water table at depth of 6 to 18 inches.	Dense clayey subsoil; difficult to work.	Dense clayey subsoil; difficult to work; subject to seepage and sloughing; somewhat poorly drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Collamer: CoB, CoC, CoD	Good to depth of about 14 inches; generally clayey below this depth.	Unsuitable	Poor to fair: highly erodible silt and very fine sand.	Seasonal high water table at depth of 18 inches; cut slopes highly erodible and subject to seepage and sloughing; poor subgrade conditions in cuts; subject to differential frost heave. CoD: moderately steep; common irregular short slopes; seasonally poor trafficability.	Generally adequate strength for moderately high embankments on CoB and CoC and low embankments on CoD; underlain by soft wet materials in places.
Conesus: CrA, CrB, CrC	Poor: gravelly.	Unsuitable	Good, but some large stones.	Seasonal high water table at depth of 18 to 24 inches; seepage in cuts; generally good trafficability.	Generally adequate strength for high embankments.
Dalton: DaA, DaB	Generally good in top 15 to 18 inches.	Unsuitable	Poor in silt cap; good in underlying till; wet in places; some large stones.	Seasonal high water table at depth of 6 to 18 inches; skim cuts and fills provide nonuniform soil and subgrade conditions; cuts subject to seepage and sloughing and differential frost heave; poor trafficability when wet.	Generally adequate strength for high fills.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength; moderate to high compressibility; seasonal high water table at depth of 18 inches. CoD: moderately steep.	Sandy layers subject to excess seepage; seasonal high water table at depth of 18 inches. CoC, CoD: moderately sloping to moderately steep.	Highly erodible silty and very fine sandy material; poor to fair stability; subject to piping.	Unstable cut slopes; subject to piping. CoC, CoD: commonly short and complex, moderately sloping and moderately steep slopes.	Moderate water intake rate; moderate to high available water capacity; seasonal high water table at depth of 18 inches. CoC, CoD: commonly short and complex, moderately sloping and moderately steep slopes.	Siltation problems; highly erodible; common complex short slopes. CoD: moderately steep.	Highly erodible; siltation problems; common complex short slopes. CoD: moderately steep; moderately well drained.
Adequate strength; low compressibility; seasonal high water table at depth of 18 to 24 inches; deep excavations reach bedrock in places.	Slow or very slow permeability below depth of about 36 inches; seasonal high water table at depth of 18 to 24 inches. CrC: moderately sloping.	Good shear strength and stability; slow permeability when compacted; some large stones.	Slow or very slow permeability below depth of about 36 inches; seasonal high water table at depth of 18 to 24 inches. CrC: moderately sloping.	Moderate water intake rate; moderate to high available water capacity; rooting depth restricted mainly to top 25 inches; seasonal high water table at depth of 18 to 24 inches. CrC: moderately sloping.	Generally no adverse features.	Subject to seepage. CrC: erodible; moderately well drained.
Generally adequate strength; seasonal high water table at depth of 6 to 18 inches.	Slow permeability below depth of about 18 inches; seasonal high water table at depth of 6 to 18 inches.	Unstable and highly erodible material in silt cap; stable underlying till; slow permeability when compacted; some large stones.	Slow permeability below depth of about 18 inches; seasonal high water table at depth of 6 to 18 inches; ditchbanks unstable; siltation problems.	Moderate to slow water intake rate; rooting depth restricted mainly to top 18 inches; moderate available water capacity; seasonal high water table at depth of 6 to 18 inches.	Highly erodible in silt cap; siltation problems; slowly permeable fragipan below depth of about 18 inches.	Subject to seepage; unstable ditchbanks; siltation problems; somewhat poorly drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Danley: DeB, DeC, DlD3 DlE3.	Fair in surface layer; contains shale chips. DlD3, DlE3: poor; clayey.	Unsuitable	Good	Seasonal high water table at depth of 18 to 24 inches; cut slopes subject to seepage and sloughing; generally good subgrade in cuts; deep cuts reach bedrock in places. DlD3, DlE3: alignments should not parallel slope faces; poor trafficability. DeB, DeC: generally good trafficability.	Generally adequate strength for high embankments. DlD3, DlE3: moderately steep and steep.
Darien: DnA, DnB, DnC	Fair in surface layer; contains shale fragments.	Unsuitable	Good: wet in places.	Seasonal high water table at depth of 6 to 18 inches; cut slopes subject to seepage and sloughing; generally good subgrade in cuts; deep cuts reach bedrock in places; poor trafficability when wet.	Generally adequate strength for high embankments.
Ellery: Ee	Fair in surface layer; some gravel.	Unsuitable	Good: wet in places; some large stones.	Prolonged high water table at depth of less than 6 inches; common depressional relief; seepage and sloughing above pan in cuts; subgrade in cuts generally wet; poor trafficability.	Generally adequate strength for high embankments.
Erie: ErA, EsB, EsC	ErA: fair in surface layer; some channery fragments. EsB, EsC: poor; many channery fragments.	Unsuitable	Good: wet in places; some large stones	Seasonal high water table at depth of 6 to 18 inches; bedrock in some cuts; subject to seepage and sloughing above pan in cuts; generally good subgrade in cuts, but seasonally wet; poor trafficability when wet.	Generally adequate strength for high fills.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength; bedrock in some excavations; seasonal high water table at depth of 18 to 24 inches. DlD3, DlE3: adverse slopes.	Moderately slow or slow permeability below depth of about 12 inches; seasonal high water table at depth of 18 to 24 inches. DeC, DlD3, DlE3: adverse slopes.	Fair to poor stability; shaly material; slow permeability when compacted; poor workability when wet.	Moderately slow or slow permeability below depth of about 12 inches; seasonal high water table at depth of 18 to 24 inches; cut slopes subject to seepage and sloughing. DeC, DlD3, DlE3: moderately sloping to steep.	Moderate to slow water intake rate; rooting depth mainly in top 24 inches; moderate available water capacity; seasonally high water table at depth of 18 to 24 inches. DeC, DlD3, DlE3: moderately sloping to steep.	DeB, DeC: generally no adverse features. DlD3, DlE3: moderately steep and steep.	Subject to seepage and sloughing; moderately well drained. DlD3, DlE3: adverse slopes; erodible.
Generally adequate strength; bedrock in some excavations; seasonal high water table at depth of 6 to 18 inches.	Moderately slow or slow permeability below depth of about 12 inches; seasonal high water table at depth of 6 to 18 inches. DnC: adverse slopes.	Fair to poor stability; shaly material; slow permeability when compacted; poor workability when wet.	Moderately slow or slow permeability below depth of about 12 inches; seasonal high water table at depth of 6 to 18 inches; cut slopes subject to seepage and sloughing. DnC: moderate slope.	Slow water intake rate; rooting depth mainly in top 15 to 20 inches; moderate available water capacity; seasonal high water table at depth of 6 to 18 inches. DnC: moderate slope.	Generally no adverse features.	Subject to prolonged flow; sloughing problems on ditchbanks; somewhat poorly drained.
Generally adequate strength; prolonged high water table at depth of less than 6 inches.	Slow permeability below depth of about 15 inches; prolonged high water table at depth of less than 6 inches.	High organic-matter content in surface layer; good stability in underlying material; slow permeability when compacted; some large stones.	Slowly permeable fragipan at depth of about 15 inches; prolonged high water table at depth of less than 6 inches; common depressional relief.	Generally not applicable; prolonged high water table at depth of less than 6 inches.	Flat or depressional areas.	Flat or depressional relief; seepage and sloughing problems above pan; prolonged flow; poorly drained.
Generally adequate strength; seasonal high water table at depth of 6 to 18 inches; bedrock in some excavations.	Slow permeability below depth of about 15 inches; seasonal high water table at depth of 6 to 18 inches; bedrock in some excavations. EsC: adverse slope.	Good stability; slow permeability when compacted; some large stones.	Slow permeability in fragipan at depth of about 15 inches; seasonal high water table at depth of 6 to 18 inches; ditchbanks subject to seepage and sloughing. EsC: moderate slope.	Slow water intake rate; rooting depth mainly in 10- to 16-inch zone above fragipan; low to moderate available water capacity; seasonal high water table at depth of 6 to 18 inches. EsC: moderate slope.	Generally no adverse conditions.	Seepage and sloughing problems above pan; somewhat poorly drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Fremont: FrA, FrB, FsC	Fair to poor in surface layer; contains shale or channery fragments; very acid.	Unsuitable	Generally good	Seasonal high water table at depth of 6 to 18 inches; cut slopes subject to seepage and sloughing; generally good subgrade in cuts, but wet in places; bedrock in some cuts; poor trafficability when wet.	Generally adequate strength for high embankments.
Fremont and Hornell: [1] FtD, FtE.	Poor: clayey or many channery or shaly fragments.	Unsuitable	Fair to poor: variable shear strength and compressibility; poor workability when wet; Hornell soil has low yield over rock; moderately steep and steep.	Seasonal high water table at depth of 6 to 18 inches; alignments parallel to slope faces need to be avoided; cut slopes subject to seepage and sloughing; rock in most cuts.	Generally adequate strength for high embankments, but benching generally needed.
Halsey: Ha	Fair in surface layer; gravelly in places; wet in natural state.	Fair in places; underwater excavation problems.	Good: wet in natural state.	Prolonged high water table at surface; depressional relief; cuts should be avoided; cuts subject to differential frost heave if drained and used; poor trafficability when wet.	Generally adequate strength for low embankments; underlain by wet compressible material in places.
Hamlin: Hc	Very good to depth of 40 inches or more; gravelly below depth of 40 inches in places; seasonally wet in lower subsoil in places.	Unsuitable to a depth of 40 inches; suitable below that depth in places.	Poor in silty material; suitable in gravelly material below depth of 40 inches where present.	Subject to flooding; cuts not recommended; poor trafficability when wet.	Generally adequate strength for low embankments.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Adequate strength; seasonal high water table at depth of 6 to 18 inches.	Moderately slow permeability in subsoil; slow or very slow in substratum below depth of about 28 inches; seasonal high water table at depth of 6 to 18 inches. FsC: adverse slope.	Good stability; slow permeability when compacted; difficult to work in places when wet.	Moderately slow permeability below depth of about 9 inches and slow or very slow below 28 inches; seasonal high water table at depth of 6 to 18 inches; ditchbanks subject to seepage and sloughing. FsC: moderate slope.	Slow water intake rate; rooting depth is mainly in the top 15 to 24 inches; moderate to high available water capacity; seasonal high water table at depth of 6 to 18 inches. FsC: moderate slope.	Generally no adverse features.	Subject to prolonged flow; sloughing problems on ditchbanks; somewhat poorly drained.
Not generally applicable; adverse relief.	Not applicable; adverse relief.	Variable shear strength and compressibility; Hornell soil has low yield over bedrock; generally difficult to work when wet.	Not applicable; adverse relief.	Not applicable; adverse relief.	Not applicable; adverse relief.	Not applicable; adverse relief.
Generally not applicable; prolonged high water table at surface; large settlements occur under heavy or vibratory loads in places.	Rapid permeability in substratum.	Pervious material; good for outside shell; wet in natural state in places; some cobble-sized fragments.	Prolonged high water table at surface; contains sandy lenses; subject to piping; unstable ditchbanks; outlets difficult to establish in places.	Generally not applicable; prolonged high water table at surface.	Flat or depressional relief.	Flat or depressional relief; prolonged high water table at surface.
Not applicable; subject to flooding.	Subject to flooding; moderate permeability; water table below depth of 30 inches in places.	Highly erodible; variable permeability when compacted; subject to piping; wet in substratum in places.	Subject to flooding, but drainage generally not needed; water table below depth of 30 inches for brief periods.	Moderate water intake rate; unrestricted root zone; high available water capacity; subject to flooding, but rarely during growing season.	Not applicable; nearly level.	Not applicable; nearly level.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Herkimer: HeA, HeB	Poor: shaly.	Poor: contains weak, easily weatherable shale.	Good	Subject to rare flash flooding in places; water table below depth of 24 inches in places; cut slopes subject to differential frost heave; generally good trafficability.	Generally adequate strength for low embankments.
Homer: Hg, Hh	Poor: gravelly.	Unit Hg is good but under water in places. Unit Hh is same as Hg above depths of 60 to 120 inches; below these depths it is underlain by wet silt and clay which are unsuitable.	Unit Hg is good; wet in places; few cobblestones. Unit Hh is same as Hg above depths of 60 to 120 inches, but wet silt and clay below these depths are poor or unsuitable.	Seasonal high water table at depth of 6 to 18 inches; seepage and sloughing in cuts; seasonally wet subgrade in cuts; subject to differential frost heave; poor trafficability when wet. Deep cuts in unit Hh will expose unstable silt and clay.	Unit Hg: generally adequate strength for moderately high embankments. Unit Hh: low strength; all sites should be investigated.
Hornell: HlA, HlB, HlC	Poor: high clay content; some shale fragments; very acid.	Unsuitable	Poor: clayey; low shear strength; 20 to 40 inches deep over shale bedrock.	Seasonal high water table at depth of 6 to 18 inches; shale bedrock in cuts at depth of 20 to 40 inches; cuts unstable and subject to seepage.	Adequate strength for high embankments.
Howard: HmA, HmB, HmC, HmD.	Poor: gravelly.	Good: cemented in places.	Good: some cobblestones more than 3 inches in diameter.	Highway grade not critical, except as influenced in places by water table at depth of 3 to several feet; local seepage and sloughing in cuts; subgrade of stratified material in cuts subject to severe differential frost heave. HmC, HmD: common, irregular, short slopes. HmD: moderately steep; good trafficability except where slopes are steeper.	Generally adequate strength for high embankments. HmD. moderately steep.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength; large settlements occur under vibratory or very heavy loads in places; subject to rare flash flooding in places; water table below depth of 24 inches in places.	Moderate to moderately rapid permeability in subsoil; rapid permeability in substratum.	Good stability; generally slow or moderately slow permeability when compacted.	Generally not applicable; water table below depth of 24 inches in places.	Moderate to rapid water intake rate; rooting depth generally unrestricted; moderate available water capacity.	Moderate to moderately rapid permeability in subsoil; rapid permeability in substratum; fair to poor stability.	Fair to poor stability; well drained to moderately well drained.
Unit Hg: generally adequate strength; seasonal high water table at depth of 6 to 18 inches; large settlements occur under very heavy or vibratory loads in places. Unit Hh: not recommended for this purpose; excavations generally expose a water table and wet, soft, flowing silt and clay.	Seasonal high water table at depth of 6 to 18 inches; moderately rapid or rapid permeability in gravelly and sandy substrata. Deep excavations in unit Hh will expose pervious lenses of sand and silt in places in otherwise slowly permeable material.	Unit Hg: pervious material in most instances; good for outside shell. Unit Hh: same as Hg above 60 to 120 inches, but wet silt and clay below these depths are highly erodible, unstable, and difficult to work.	Seasonal high water table at depth of 6 to 18 inches; contains sand lenses in places; subject to piping; unstable ditchbanks.	Generally not applicable; seasonal high water table at depth of 6 to 18 inches.	Flat or depressional relief.	Flat or depressional relief; variable stability; somewhat poorly drained.
Adequate strength; seasonal high water table at depth of 6 to 18 inches; shale bedrock in excavations 20 to 40 inches below surface.	Shale bedrock at depth of 20 to 40 inches. HlC: moderately sloping.	Fair to poor stability; slow permeability when compacted; poor workability when wet; low yield; 20 to 40 inches deep over shale bedrock.	Seasonal high water table at depth of 6 to 18 inches; 20 to 40 inches over shale bedrock. HlC: moderately sloping.	Slow water intake rate; limited rooting depth; low to moderate available water capacity; seasonal high water table at depth of 6 to 18 inches. HlC: moderately sloping.	Shale bedrock at depth of 20 to 40 inches.	Subject to seepage and prolonged flow; 20 to 40 inches deep over shale bedrock; somewhat poorly drained to moderately well drained.
Generally adequate strength; compressible under very heavy or vibratory loads; very deep excavations expose water table in places. HmD: moderrately steep.	Pervious material; excessive seepage.	Good stability for outside shell; pervious when compacted; some cobblestones more than 3 inches in diameter.	Not applicable; well drained to somewhat excessively drained.	Rapid water intake rate; unrestricted rooting depth; low to moderate available water capacity.	Moderately rapid to rapid permeability; high gravel content; difficult to vegetate; common, irregular short slopes. HmD: moderately steep.	Moderately rapid or rapid permeability; high gravel content; difficult to vegetate; common, irregular short slopes. HmD: moderately steep; well drained to somewhat excessively drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
HnA, HnB, HnC	Poor: shaly	Unsuitable	Good	Highway grade not critical, except as influenced in places by water table at depth of 3 to several feet; local seepage and sloughing in cuts; subgrade of stratified material in cuts subject to severe differential frost heave; good trafficability except where slopes are steeper; deep cuts on deltas expose wet silt and clay.	Generally adequate strength for low embankments on deltas; underlain by soft, wet, weak sediment in places; generally adequate strength for high fills on outwash terraces.
Howard-Madrid: [1] HoB, HoC, HoD	Poor: gravelly; droughty.	Fair to good in Howard soil, poorly sorted in places; thick overburden in Madrid soil overlies sand and gravel deposits in places.	Good: some cobblestones more than 3 inches in size; some large stones.	Highway grade not critical, except as influenced in places by water table at depth of 3 to several feet; cut slopes have sloughing and seepage problems in places, severe where silt strata encountered; nonuniform soil conditions on subgrades in cuts; subject to severe differential frost heave; common, irregular short slopes. HoD: moderately steep; generally good trafficability except where slopes are steeper.	Generally adequate strength for moderately high embankments. HoD: moderately steep.
HrB, HrC, HrD	Poor: shaly.	Unsuitable shaly material with high silt content.	Good	Highway grade not critical, except as influenced in places by water table at depth of 3 to several feet; cut slopes have sloughing and seepage problems in places, severe where silt strata encountered; nonuniform soil conditions on subgrades in cuts; subject to severe differential frost heave; generally good trafficability except where slopes are steeper.	Generally adequate strength for moderate high embankments. HrD: moderately steep.
Howard and Chenango: [1] HsE.	Unsuitable: gravelly; droughty.	Generally good; poorly sorted or contains shale in places; cemented in places; steep slopes.	Generally good; some cobblestones more than 3 inches in size where slopes are steep.	Highway grade not critical, except as influenced by water table, local seepage, and sloughing in deep cuts; subgrade of stratified material in cuts subject to severe differential frost heave; steeply sloping; very poor trafficability.	Generally adequate strength for high embankments, but generally requires benching because of steep slopes.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength; underlain by soft, wet, weak sediment in places; compressible under vibratory loads; deep excavations expose water table and wet, soft sediment in places.	Pervious material; excessive seepage.	Good stability; very high shale content; variable permeability when compacted.	Not applicable; well drained to somewhat excessively drained.	Moderate to rapid water intake rate; otherwise same as Howard gravelly loam.	Moderate to moderately rapid permeability in subsoil; high shale content; difficult to vegetate.	Moderate to moderately rapid permeability in subsoil; high shale content; difficult to vegetate; well drained to somewhat excessively drained.
Generally adequate strength. HoD: moderately steep; water table in deep excavations in places.	Variable permeability over short distances, but generally rapid permeability in substratum. HoC, HoD: adverse slopes.	Good stability; good for outside shell; variable permeability when compacted; some large stones.	Not applicable; well drained to somewhat excessively drained.	Rapid water intake rate; unrestricted rooting depth; available water capacity ranges from low in Howard soil to high in Madrid soil. HoC, HoD: moderately sloping and moderately steep.	Moderately rapid or rapid permeability; high gravel content in places; difficult to vegetate; common, irregular short slopes. HoD: moderately steep.	Moderately rapid or rapid permeability; high gravel content in places; difficult to vegetate; common, irregular short slopes. HoD: moderately steep; well drained.
Generally adequate strength. HrD: moderately steep; water table in excavations in places.	Variable permeability over short distances, but generally rapid permeability in substratum. HrC, HrD: adverse slopes.	Good stability; very high shale content; variable permeability when compacted.	Not applicable; well drained to somewhat excessively drained.	Moderate to rapid water intake rate; unrestricted rooting depth; moderate to high available water capacity. HrC, HrD: moderately sloping and moderately steep.	Moderate to moderately rapid permeability in subsoil; high shale content in places; difficult to vegetate. HrD: moderately steep.	Moderate to moderately rapid permeability in subsoil; high shale content in places; difficult to vegetate; well drained to somewhat excessively drained. HrD: moderately steep.
Not recommended for this purpose; steep.	Not applicable; steep.	Good stability for outside shell; rapid permeability; some cobblestones more than 3 inches in size.	Not applicable; steep.	Not applicable; steep.	Not applicable; steep.	Not applicable; steep.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Ilion: In	Fair to poor in surface layer; some shale fragments; generally wet in natural state; high clay content in places.	Unsuitable	Poor: wet for long periods; high clay content.	Prolonged high water table at surface; cuts subject to severe seepage and sloughing problems; wet clayey subgrade in cuts; poor trafficability.	High organic-matter content in surface layer; otherwise generally adequate strength for high embankments.
Langford: LaA, LaB, LaC, LaD.	Poor: channery.	Unsuitable	Generally good; some large stones; bedrock in deep excavations in places.	Seasonal high water table at depth of 18 to 24 inches; seepage and sloughing in cuts above fragipan at depth of about 20 inches; generally good subgrade in cuts, but seasonally wet; bedrock in some cuts. LaD: moderately steep; generally good trafficability except when wet.	Generally adequate strength for high embankments. LaD: moderately steep.
Lansing: LgB, LgC, LgD, LgE.	Poor: gravelly.	Unsuitable	Good: some large stones.	Highway grade location generally not critical. LgD, LgE: moderately steep and steep; bedrock in some cuts; seepage and sloughing in some cuts; generally good subgrade in cuts; generally good trafficability except where slopes are steeper.	Generally adequate strength for high embankments. LgD, LgE: moderately steep and steep.
Lordstown: LoB, LoC, LoD, LoE.	Poor to unsuitable; channery; very acid; thin.	Unsuitable	Good, but low yield; some large stones; 20 to 40 inches deep over mostly sandstone bedrock.	LoB, LoC, LoD: highway grade generally not critical. LoE: alignments parallel to rock face need to be avoided; rock in most cuts; sloughing and seepage above rock; good subgrade in rock cuts; good trafficability except where slopes are steeper.	Adequate strength for high embankments. LoD, LoE: moderately steep and steep.

of engineering properties—Continued

Soil features affecting—Continued							
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Prolonged high water table at surface.	Moderately slow or slow permeability below depth of about 14 inches; prolonged high water table at surface; depressional relief in places.	Fair to poor stability; slow permeability when compacted; generally wet and difficult to work.	Prolonged high water table at surface; unstable cut slopes; slow internal water movement; depressional relief in places.	Generally not irrigated; prolonged high water table at surface.	Flat or depressional relief.	Flat or depressional relief; subject to prolonged flow; cut slopes subject to seepage and sloughing; poorly drained.
Generally adequate strength; seasonal high water table at depth of 18 to 24 inches. LaD: moderately steep.	Slow or very slow permeability below depth of about 20 inches; seasonal high water table at depth of 18 to 24 inches. LaC, LaD: adverse topography.	Good stability; slow permeability when compacted; some large stones.	Slow or very slow permeability below depth of about 20 inches; seasonal high water table at depth of 18 to 24 inches; ditchbanks subject to seepage and sloughing above fragipan. LaC, LaD: moderately sloping and moderately steep.	Moderate to slow water intake rate; rooting depth restricted to zone above fragipan or about 20 inches; low to moderate available water capacity. LaC, LaD: moderately sloping and moderately steep.	LaA, LaB, LaC: generally no adverse features. LaD: moderately steep.	Ditchbanks subject to seepage and sloughing above fragipan. LaD: moderately steep; moderately well drained to well drained.
Adequate strength; low compressibility. LgD, LgE: moderately steep and steep.	Slow or very slow permeability below depth of about 39 inches. LgC, LgD, LgE: adverse relief.	Good stability and shear strength; slow permeability when compacted; some large stones.	Generally not needed; well drained.	Moderate water intake rate; rooting depth of 30 inches or more; high available water capacity. LgC, LgD, LgE: moderately sloping to steep.	LgB, LgC: generally no adverse features. LgD, LgE: moderately steep and steep.	Erodible on steeper slopes. LgD, LgE: moderately steep and steep; well drained.
Bedrock at depth of 20 to 40 inches. LoD, LoE: moderately steep and steep.	Bedrock at depth of 20 to 40 inches. LoC, LoD, LoE: adverse slope.	Low yield; some large stones; moderately slow or slow permeability when compacted.	Generally not needed; well drained.	Moderate water intake rate; rooting restricted to 20- to 40-inch zone above bedrock; low to moderate available water capacity. LoC, LoD, LoE: moderately sloping to steep.	Bedrock at depth of 20 to 40 inches. LoD, LoE: moderately steep and steep.	Bedrock at depth of 20 to 40 inches. LoD, LoE: moderately steep and steep; well drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Lyons: Ly	Fair in surface layer; wet in places; a few coarse fragments in places.	Unsuitable	Poor in surface layer and subsoil; generally good in substratum, but wet and contains some large stones in places; generally poor trafficability.	Prolonged high water table at surface; wet and unstable cut slopes; wet subgrade in cuts; poor trafficability.	Generally adequate strength for high embankments.
Madrid: MaB, MaC, MdB, MdC.	Fair in surface layer; some coarse fragments; strongly acid.	Unsuitable	Good: some large stones.	Localized seepage and sloughing in cuts; generally good subgrade in cuts; generally good trafficability.	Generally adequate strength for high embankments.
Manlius: MlB, MlC, MlD, MlE.	Unsuitable: shaly.	Unsuitable	Poor: low yield; 20 to 40 inches deep over brittle shale bedrock.	Shale bedrock at depth of 20 to 40 inches; generally highway grade not critical; rock in most cuts; sloughing and seepage above rock; subgrade in rock cuts generally good. MlE: alignments parallel to rock face need to be avoided. MlD, MlE: moderately steep and steep; good trafficability except where slopes are steeper.	Adequate strength for high embankments. MlD, MlE: moderately steep and steep.
Manlius and Lordstown: [1] MnF.	Unsuitable	Unsuitable	Unsuitable: excavations mostly in bedrock; precipitous slopes.	Shale or sandstone bedrock at depth of 20 to 40 inches; very steep slopes; alignments parallel to rock face need to be avoided; rock in cuts; seepage above rock; good subgrade in rock cuts; not trafficable.	Adequate strength for high embankments, but generally adverse locations.

See footnote at end of table.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength; prolonged high water table at surface.	Prolonged high water table at surface; slow or very slow permeability below depth of about 28 inches; flat or depressional relief.	Silty surface and subsoil have poor stability and are highly erodible; substratum generally has good stability and slow permeability when compacted; usually wet; contains some large stones.	Prolonged high water table at surface; unstable ditchbanks; slow or very slow permeability below depth of about 28 inches; outlets difficult to establish in places.	Prolonged high water table at surface; generally not irrigated.	Flat or depressional relief.	Flat or depressional relief; unstable ditchbanks; subject to prolonged flow; poorly drained to very poorly drained.
Generally no adverse features.	Pervious layers subject to excess seepage. MaC, MdC: moderately sloping.	Good stability: generally slow permeability when compacted; some large stones.	Generally not needed; well drained.	Moderate to rapid water intake rate; rooting depth is 30 inches or more; moderate to high available water capacity. MaC, MdC: moderately sloping.	Pervious layers in places; irregular short slopes in places.	Siltation problems in places; well drained; irregular short slopes in places.
Adequate strength; rock in excavations. MlD, MlE: moderately steep and steep.	Shale bedrock at depth of 20 to 40 inches. MlC, MlD, MlE: adverse relief.	High shale content; variable stability; low yield; 20 to 40 inches deep over brittle shale bedrock.	Generally not needed; well drained to excessively drained.	Moderate water intake rate; rooting depth restricted mainly to 20- to 40-inch zone above shale; low to moderate available water capacity. MlC, MlD, MlE: moderately sloping to steep.	Shale bedrock at depth of 20 to 40 inches. MlD, MlE: moderately steep and steep.	Shale bedrock at depth of 20 to 40 inches. MlD, MlE: moderately steep and steep; well drained.
Not applicable; very steep.	Not applicable; very steep.	Excavations mostly in shale or sandstone bedrock; precipitous slopes; very low yield; variable permeability.	Not applicable; well drained to excessively drained; nonagricultural soils.	Not applicable; very steep; nonagricultural soils.	Not applicable; very steep.	Not applicable; very steep.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Mardin: MrA, MrB, MrC, MrD.	Poor: channery.	Unsuitable	Good, but some large stones.	Dense fragipan at depth of 14 to 24 inches; skim cuts and fills provide nonuniform soil and subgrade conditions; seasonal high water table at depth of 12 to 24 inches; subject to seepage and sloughing in cuts above pan; generally good subgrade in deeper cuts; bedrock in some cuts. MrD: moderately steep; good trafficability, except when wet and where slopes are steeper.	Generally adequate strength for high embankments. MrD: moderately steep.
Marilla: MsB, MsC	Poor: shaly.	Unsuitable	Good	Dense, slowly permeable or very slowly permeable fragipan at depth of 15 to 25 inches; seasonal high water table at depth of 12 to 24 inches; skim cuts provide nonuniform soil and subgrade conditions; seepage in cuts above fragipan; bedrock in deep cuts, but generally good subgrade in deeper cuts; good trafficability when dry.	Generally adequate strength for high embankments.
Niagara: Ng	Good	Unsuitable	Poor to fair: highly erodible in silt and very fine sand.	Seasonal high water table at depth of 12 inches; unstable cut slopes subject to seepage and sloughing; subgrade in cuts wet and unstable in places; stratified subgrade subject to differential frost heave; poor trafficability when wet.	Generally adequate strength for moderately high embankments; underlain by soft, wet sediment in places.

of engineering properties—Continued

Soil features affecting—Continued							
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Adequate strength; low compressibility; seasonal high water table at depth of 12 to 24 inches. MrD: adverse relief.	Slow or very slow permeability below depth of about 14 to 24 inches; seasonal high water table at depth of 12 to 24 inches. MrC, MrD: adverse slopes.	Good stability and shear strength; slow permeability when compacted; some large stones.	Slow or very slow permeability below depth of about 14 to 24 inches; seasonal high water table at depth of 12 to 24 inches; ditchbanks subject to seepage and sloughing above fragipan. MrC, MrD: moderately sloping and moderately steep.	Moderate to slow water intake rate; rooting depth restricted to 14- to 24-inch zone above fragipan; moderate to low available water capacity; seasonal high water table at depth of 12 to 24 inches. MrC, MrD: moderately sloping and moderately steep.	MrA, MrB, MrC: generally no adverse features. MrD: moderately steep.	Slowly permeable or very slowly permeable fragipan at depth of 14 to 24 inches; subject to seepage and sloughing above pan. MrD: moderately steep; moderately well drained.
Generally adequate strength; low compressibility; seasonal high water table at depth of 12 to 24 inches; bedrock in some deeper excavations.	Slow or very slow permeability to depth of 15 to 25 inches; seasonal high water table at depth of 12 to 24 inches.	Generally good stability; slow permeability when compacted.	Slowly permeable or very slowly permeable fragipan at depth of 15 to 25 inches; seasonal high water table at depth of 12 to 24 inches; ditchbanks subject to seepage and sloughing above pan.	Moderate to slow water intake rate; rooting depth restricted to 15- to 25-inch zone above fragipan; low to moderate available water capacity. MsC: moderately sloping.	Generally no adverse features.	Slowly permeable or very slowly permeable fragipan at depth of 15 to 25 inches; subject to seepage and sloughing above pan; moderately well drained.
Generally adequate strength for light buildings; seasonal high water table at depth of 12 inches.	Seasonal high water table at depth of 12 inches; contains sandy layers subject to excess seepage during dry periods.	Silty and very fine sandy materials; highly erodible; poor to fair stability; subject to piping.	Seasonal high water table at depth of 12 inches; unstable cut slopes; siltation problems; subject to piping.	Moderate water intake rate; rooting depth mainly in top 15 to 24 inches; moderate to high available water capacity; seasonal high water table at depth of 12 inches.	Nearly level----	Nearly level; unstable ditchbanks; siltation problems; somewhat poorly drained

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Nunda: NuB, NuC, NuD	Generally good in surface layer and upper part of subsurface layer; a few coarse fragments in places.	Unsuitable	Poor in silty cap, 15 to 30 inches thick; highly erodible; generally good in underlying subsoil and substratum where in till deposits; locally poor where underlying deposits are lake-laid silts and clays.	Seasonal high water table at depth of 18 to 30 inches; 15- to 30-inch silty cap generally over shaly till, but locally over lacustrine silt and clay; cut slopes subject to severe seepage and sloughing; subgrade in cuts generally good in till; otherwise generally unstable. NuD: moderately steep; poor trafficability when wet and where slopes are steeper.	NuB, NuC: generally adequate strength for high embankments where underlain by till. NuD: generally adequate strength for moderately high embankments where underlain by till; all units have adequate strength for low fills where underlain by lacustrine sediment.
Palms: Pa	Possible use as amendment for mineral soils; many roots in wooded areas.	Unsuitable	Unsuitable	Prolonged high water table; wet, compressible, organic material about 16 to 50 inches thick; not trafficable.	Unsuitable in natural state; organic material must be removed and replaced with suitable underwater backfill.
Palmyra: PgA, PgB	Poor: too gravelly.	Good: cemented in places.	Good	Highway grade location not critical, except as influenced by water table which is rarely within 42 inches of surface; seepage and sloughing problems in places in deep cuts; subgrade in cuts is stratified material subject to differential frost heave; good trafficability.	Generally adequate strength for high embankments.
Papakating: Pk, Pm	Generally good; contains roots; generally wet.	Fair to poor: available in places in deep substratum; problems of underwater excavation.	Poor to depth of about 40 inches; wet silty material; deep substratum; good in places but generally under water.	Subject to flooding; prolonged high water table at depth of less than 6 inches; cuts should be avoided; very poor trafficability.	High organic content in surface layer; variable conditions in subsurface layer.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength for light buildings; seasonal high water table at depth of 18 to 30 inches. NuD: adverse slope.	Moderately slow or slow permeability below depth of about 27 inches; seasonal high water table at depth of 18 to 30 inches. NuC, NuD: adverse slope.	Highly erodible silty cap about 15 to 30 inches thick; subject to piping; stable and slowly permeable underlying till subsoil and substratum when compacted; locally poor stability and poor workability when wet, where underlain by silty and clayey lacustrine sediments.	Seasonal high water table at depth of 18 to 30 inches; cut slopes very unstable in 15- to 30-inch silty cap; siltation problems; moderately slow or slow permeability below depth of about 27 inches. NuC, NuD: moderately sloping and moderately steep.	Moderate to slow water intake rate; rooting mainly in top 24 to 36 inches; moderate to high available water capacity; seasonal high water table at depth of 18 to 30 inches. NuC, NuD: moderately sloping and moderately steep.	Variable depth to moderately slowly permeable or slowly permeable layers; subject to seepage; siltation problems. NuD: moderately steep.	Highly erodible silty cap about 15 to 30 inches thick; siltation problems; subject to seepage; moderately well drained. NuD: moderately steep.
Not applicable----	Prolonged high water table; depth to mineral material of variable permeability ranges from 16 to 50 inches.	Unsuitable for this purpose.	Generally not drained; prolonged high water table; underlying mineral material at depths of 16 to 50 inches; very high shrinkage when first drained.	Generally not irrigated; prolonged high water table; rooting depths dependent on water table; variable available water capacity.	Flat or depressional relief.	Flat or depressional relief; very poorly drained; organic material about 16 to 50 inches thick over mineral soil.
Generally adequate strength; compressible under very heavy and vibratory loads; water table in deep excavations in places.	Pervious material; excess seepage.	Good stability and shear strength; pervious when compacted; good for outside shell.	Generally not needed; well drained to excessively drained.	Rapid water intake rate; unrestricted rooting depth; low to moderate available water capacity.	Pervious material.	Pervious material; high gravel content; well drained to excessively drained.
Not recommended for this purpose because of flooding and high water table.	Subject to frequent flooding.	Very unstable, wet silty material to a depth of about 40 inches; gravelly material in deep substratum in places; good for outside shell; generally under water.	Prolonged high water table at depth of less than 6 inches; subject to frequent flooding; unstable ditchbanks; outlets difficult to establish.	Generally not irrigated; very poorly drained to poorly drained.	Depressional areas of flood plains.	Depressional areas of flood plains; poorly drained to very poorly drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Phelps: PpA, PpB	Poor: gravelly.	Good: wet in places.	Good: wet in places.	Seasonal high water table at depth of 18 inches; seepage and sloughing problems in cuts; subgrade in cuts seasonally wet and is stratified material subject to severe differential frost heave; generally good trafficability; some seep spots.	Generally adequate strength for high embankments.
Red Hook: Rh	Poor: gravelly.	Generally good; contains silt layers in places; wet in places.	Good: wet in places.	Seasonal high water table at depth of 6 to 18 inches; cut slopes subject to seepage and sloughing; wet subgrades unless drainable; stratified material subject to severe differential frost heave; poor trafficability when wet.	Generally adequate strength for high embankments.
Rock outcrop: Ro	Unsuitable	Unsuitable	Good in blasted rock material.	Mainly rock exposures in gorges where slopes are very steep; cuts subject to seepage.	Rock gorges
Scio: ScA, ScB	Generally good to depth of about 40 inches.	Unsuitable	Poor in silty surface layer and subsoil to a depth of about 40 inches; highly erodible; good in places in gravelly material in deep substratum; wet in places.	Seasonal high water table at depth of 18 to 24 inches; rare hazard of flooding on fans in places; cuts subject to seepage and sloughing; very erodible; subgrade in cuts may be wet and unstable; subject to differential frost heave; generally good trafficability, but poor when wet.	Generally adequate strength for low embankments.
Sun: Su	Good in surface layer; fair in subsoil to depth of about 21 inches; wet in places; slightly gravelly in places.	Unsuitable	Poor in silty surface layer and subsurface layer; highly erodible; generally good in gravelly lower subsoil and substratum, but generally wet.	Prolonged high water table at depth of less than 6 inches; seepage and sloughing problems in cuts; wet subgrades in cuts; surface soil high in organic-matter content and unstable; poor trafficability.	Generally adequate strength for high embankments.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Generally adequate strength; seasonal high water table at depth of 18 inches.	Pervious material; subject to excess seepage.	Good stability and shear strength; variable permeability when compacted; generally good for outside shell.	Seasonal high water table at depth of 18 inches; ditchbanks subject to seepage and sloughing; pervious material throughout.	Moderate to rapid water intake rate; rooting depth mainly in top 24 to 30 inches; moderate available water capacity; seasonal high water table at depth of 18 inches.	Pervious material.	Pervious material; high gravel content in cuts; erodible sandy layers; subject to prolonged seepage in places; moderately well drained.
Generally adequate strength; compressible under very heavy or vibratory loads; seasonal high water table at depth of 6 to 18 inches.	Pervious material subject to excess seepage; seasonal high water table at depth of 6 to 18 inches.	Good stability and shear strength; variable permeability when compacted; generally good for outside shell.	Seasonal high water table at depth of 6 to 18 inches; ditchbanks subject to seepage and sloughing; pervious material.	Moderate water intake rate; rooting depth mainly in top 15 to 20 inches; low available water capacity; seasonal high water table at depth of 6 to 18 inches.	Pervious material; nearly level.	Nearly level relief; cut slopes subject to seepage and sloughing; subject to prolonged flow; somewhat poorly drained.
Not applicable; rock gorges.	Not applicable; rock gorges.	Not applicable; rock gorges.	Not applicable; rock gorges.	Not applicable; rock gorges.	Not applicable; rock gorges.	Not applicable; rock gorges.
Generally adequate strength; seasonal high water table at depth of 18 to 24 inches; variable compressibility.	Pervious layers subject to excess seepage during dry periods.	Poor stability in silty and very fine sandy material; subject to piping; gravelly material in deep substratum; suitable in places for outside shell; generally wet.	Seasonal high water table at depth of 18 to 24 inches; cut slopes highly erodible; siltation problems; subject to piping.	Moderate water intake rate; rooting depth mainly in the top 24 to 30 inches; moderate to high available water capacity; seasonal high water table at depth of 18 to 24 inches.	Pervious layers subject to seepage.	Cut slopes very erodible; siltation problems; moderately well drained.
Generally adequate strength; prolonged high water table at depth of less than 6 inches; some ponding.	Prolonged high water table at depth of less than 6 inches; moderately slow or slow permeability below depth of about 21 to 30 inches.	Unstable surface layer high in organic-matter content; good stability and shear strength in subsoil and substratum; slow permeability when compacted.	Prolonged high water table at depth of less than 6 inches; moderately slow or slow permeability below depth of about 21 to 30 inches; ditchbanks subject to seepage and sloughing.	Generally not irrigated; poorly drained and very poorly drained.	Flat or depressional relief.	Flat or depressional relief; cut slopes subject to sloughing; prolonged flow; poorly drained and very poorly drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Teel: Te	Generally good to depth of 40 inches or more.	Unsuitable	Poor: highly erodible silty sediment; wet in places.	Subject to flooding; seasonal high water table at depth of 18 to 24 inches; cuts not recommended; poor trafficability when wet.	Generally adequate strength for low embankments.
Tioga: Tg	Generally good to depth of 40 inches or more.	Generally unsuitable; good in places below depth of 40 inches, but wet.	Poor in silty material to depth of 40 inches or more; highly erodible; good in places in gravelly material below depth of 40 inches, but generally wet.	Subject to flooding; water table below depth of 24 inches; fair trafficability.	Generally adequate strength for low embankments.
Tuller: TuA, TuB	Poor: channery.	Unsuitable	Poor: low yield; less than 20 inches deep over sandstone bedrock.	Sandstone bedrock at depth of less than 20 inches; extensive flat areas; seepage above and through rock strata in cuts; seasonal high water table at depth of less than 12 inches; good trafficability except when wet.	Adequate strength for high embankments.
Valois. Occurs only in a complex of Bath-Valois gravelly loams.	Poor: gravelly.	Generally unsuitable, but suitable in places.	Good, but some large stones.	Cut slopes subject to seepage and sloughing in places; subgrade in cuts subject to differential frost heave. Valois soil in BID: moderately steep; generally good trafficability.	Generally adequate strength for high embankments. Valois soil in BID: moderately steep.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Not recommended for this purpose because of flooding and high water table.	Subject to flooding; seasonal high water table at depth of 18 to 24 inches; pervious layers in places subject to excess seepage during dry periods.	Fair to poor stability in silty material; highly erodible; wet in places.	Seasonal high water table at depth of 18 to 24 inches; moderate permeability; ditchbanks subject to seepage and sloughing; subject to flooding.	Moderate water intake rate; rooting depth mainly in top 30 inches; high available water capacity; seasonal high water table at depth of 18 to 24 inches; subject to flooding.	Nearly level flood plain.	Nearly level flood plain; moderately well drained.
Subject to flooding; generally not recommended for this purpose; variable strength; water table below depth of 24 inches.	Subject to flooding; variable permeability; water table below depth of 24 inches.	Highly erodible silty material; variable permeability when compacted; subject to piping.	Subject to flooding, but drainage generally not needed; water table below depth of 24 inches for brief periods.	Moderate water intake rate; unrestricted rooting depth; high available water capacity; subject to occasional flooding.	Not applicable; nearly level flood plain.	Not applicable; nearly level flood plain.
Adequate strength; sandstone bedrock at depth of less than 20 inches; seasonal high water table at depth of less than 12 inches.	Not applicable; less than 20 inches deep over sandstone bedrock.	Less than 20 inches deep over bedrock; low yield; high stone content.	Less than 20 inches deep over sandstone bedrock; seasonal high water table at depth of less than 12 inches.	Slow water intake rate; rooting depth restricted by bedrock to less than 20 inches; low to moderate available water capacity; seasonal high water table at depth of less than 12 inches.	Not applicable; less than 20 inches deep over sandstone bedrock.	Not applicable; less than 20 inches deep over sandstone bedrock.
Generally adequate strength; compressible under heavy or vibratory loads. Valois soil in BID: moderately steep.	Contains rapidly permeable gravelly and sandy layers. Valois soil in BIC, BID: moderately sloping and moderately steep.	Good stability; variable permeability when compacted; some large stones.	Generally not applicable; well drained.	Moderate to rapid water intake rate; moderate available water capacity; unrestricted rooting depth. Valois soil in BIC, BID: moderately sloping and moderately steep.	Pervious material; complex slopes. Valois soil in BID: moderately steep.	Pervious material; complex slopes. Valois soil in BID: moderately steep; well drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Varysburg: VaB, VaC, VaD.	Poor: gravelly.	Unsuitable	Good in surface material to depth of 20 to 40 inches; unsuitable in underlying silt and clay.	Gravelly material about 20 to 40 inches thick over lacustrine silt and clay; seasonal high water table at depth of 18 to 30 inches; very unstable cut slopes; alignments parallel to slope faces need to be avoided; soft, wet, flowing soils in subgrades in cuts. VaD: moderately steep; fair trafficability except where slopes are steeper.	Generally adequate strength for light fills; shear keys and berms needed in places. VaD: moderately steep.
Volusia: VoA, VoB, VoC	Poor: many channery fragments.	Unsuitable	Good, but wet in places; some large stones.	Very slowly permeable fragipan at depth of 10 to 18 inches; seasonal high water table perched on pan for long periods at depth of 6 to 18 inches; skim cuts and fills provide nonuniform soil and commonly wet subgrade; seepage and sloughing above pan; poor trafficability when wet.	Generally adequate strength for high embankments.
Wallington: Wa	Good to a depth of about 14 inches.	Unsuitable	Poor: silty; highly erodible; wet in places.	Seasonal high water table at depth of 6 to 18 inches for long periods; cut slopes subject to severe seepage, sloughing, and erosion; subgrade in cuts generally wet silt; subject to differential frost heave; generally poor trafficability.	Generally adequate strength for low embankments.

properties significant to engineering—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Variable, but generally low strength; severe settlements occur under heavy loads in places; seasonal high water table at depth of 18 to 30 inches. VaD: adverse slope.	Seasonal high water table at depth of 18 to 30 inches; pervious material about 20 to 40 inches thick over slowly permeable or very slowly permeable silt and clay. VaC, VaD: adverse slopes.	Good stability and shear strength in gravelly material to depth of 20 to 40 inches; variable permeability when compacted; fair to poor stability in underlying silt and clay; slow permeability when compacted; poor workability when wet.	Seasonal high water table at depth of 18 to 30 inches; pervious material about 20 to 40 inches thick over slowly permeable or very slowly permeable silt and clay; unstable ditchbanks subject to prolonged seepage over clay. VaC, VaD: moderately sloping and moderately steep.	Moderate to rapid water intake rate; rooting depth mainly in the top 20 to 30 inches; moderate available water capacity; seasonal high water table at depth of 18 to 30 inches. VaC, VaD: moderately sloping and moderately steep.	Pervious material about 20 to 40 inches thick over slowly permeable or very slowly permeable silt and clay. VaD: moderately steep.	Pervious material about 20 to 40 inches thick over slowly permeable or very slowly permeable silt and clay; cut slopes subject to seepage and sloughing over clay; moderately well drained to well drained. VaD: moderately steep.
Generally adequate strength and low compressibility; seasonal high water table at depth of 6 to 18 inches for long periods.	Very slow permeability in fragipan at depth of 10 to 18 inches; seasonal high water table at depth of 6 to 18 inches. VoC: moderately sloping.	Good stability and shear strength when compacted; some large stones.	Seasonal high water table at depth of 6 to 18 inches; very slowly permeable fragipan at depth of 10 to 18 inches; prolonged seepage above pan. VoC: moderately sloping.	Slow water intake rate; rooting depth restricted to 10- to 18-inch zone above fragipan; low to moderate available water capacity; seasonal high water table at depth of 6 to 18 inches. VoC: moderately sloping.	Generally no adverse features.	Very slowly permeable fragipan at depth of 10 to 18 inches; prolonged seepage above pan; somewhat poorly drained.
Generally adequate strength; soil unstable; seasonal high water table at depth of 6 to 18 inches for long periods.	Moderately slow or slow permeability below depth of about 14 inches; thin sandy lenses in places; subject to excess seepage in dry periods; seasonal high water table at depth of 6 to 18 inches.	Highly erodible silty material; variable permeability when compacted; wet in places.	Seasonal high water table at depth of 6 to 18 inches; moderately slowly permeable or slowly permeable fragipan below depth of about 14 inches; highly erodible cut slopes; siltation problems; prolonged flow.	Slow water intake rate; rooting depth restricted mainly to 14- to 18-inch zone above fragipan; moderate available water capacity; seasonal high water table at depth of 6 to 18 inches.	Level	Level; highly erodible cut slopes; siltation problems; prolonged flow; somewhat poorly drained.

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Granular material	Fill material	Highway location	Embankment foundation
Wallkill: Wk	Good in 16- to 40-inch thick surface layer, but generally wet; poor trafficability.	Unsuitable	Unsuitable	Soft, wet alluvial sediment about 16 to 40 inches thick over organic material; subject to frequent flooding; prolonged high water table at depth of less than 6 inches; cuts need to be avoided; very poor trafficability.	Unsuitable for this purpose in natural state; onsite investigation necessary.
Wayland: Wn	Good to depth of 36 inches or more, but usually wet.	Unsuitable	Poor to unsuitable: wet, silty alluvium; highly erodible.	Subject to frequent flooding; prolonged high water table at depth of less than 12 inches; cuts need to be avoided; wet subgrades; very poor trafficability.	Generally adequate strength for low embankments.
Williamson: WoB, WoC, WsB, WsC.	WoB, WoC: good in silt loam to depth of about 15 to 17 inches. WsB, WsC: poor; many channery fragments.	Unsuitable	WoB, WoC: poor; highly erodible silt and very fine sand. WsB, WsC: good in 14 to 34 inches of channery silt loam, but low yield; poor in underlying silt and very fine sand.	Seasonal high water table at depth of 18 to 24 inches; permanent water table in deep cuts; cut slopes subject to severe seepage and sloughing; cut slopes highly erodible; subgrade in cuts; wet silt in places; poor trafficability when wet.	Generally adequate strength for low embankments.

[1] Interpretive information applies to both series in the mapping unit.

of engineering properties—Continued

Soil features affecting—Continued						
Foundations for low buildings	Farm ponds		Agricultural drainage	Irrigation	Diversions	Waterways
	Reservoir	Embankment				
Not applicable; subject to frequent flooding.	Subject to flooding; prolonged high water table at depth of less than 6 inches; silty alluvial sediment about 16 to 40 inches thick over organic material.	Not recommended for this purpose; silty alluvium about 16 to 40 inches thick over organic material.	Subject to frequent flooding; prolonged high water table at depth of less than 6 inches; unstable alluvium about 16 to 40 inches thick over organic material; highly erodible ditchbanks; outlets difficult to establish.	Generally not irrigated; very poorly drained.	Not applicable; nearly level flood plain.	Very erodible and unstable silty alluvium about 16 to 40 inches thick over organic material; prolonged flow; subject to frequent flooding; very poorly drained.
Not applicable; subject to frequent flooding; prolonged high water table at depth of less than 12 inches.	Subject to frequent flooding; prolonged high water table at depth of less than 12 inches; variable permeability.	Very unstable silty material; generally wet; highly erodible.	Subject to frequent flooding; prolonged high water table at depth of less than 12 inches; unstable cut slopes; outlets difficult to establish.	Generally not irrigated.	Low, nearly level flood plain.	Low, nearly level flood plain; poorly drained to very poorly drained.
Generally adequate strength; seasonal high water table at depth of 18 to 24 inches; ground water table in deep excavations in places.	Moderately slow or slow permeability below depth of about 17 inches; seasonal high water table at depth of 18 to 24 inches; sandy lenses in places subject to excess seepage in dry periods. WoC, WsC: moderately sloping.	Fair to poor stability in silty and very fine sandy material; highly erodible; wet in places. WsB, WsC: good stability in 14- to 34-inch thick surface layer; slow permeability when compacted; low yield.	Moderately slow or slow permeability in fragipan below depth of about 17 inches; seasonal high water table at depth of 18 to 24 inches; cut slopes unstable and highly erodible; siltation problems; subject to piping. WoC, WsC: moderately sloping.	Moderate to slow water intake rate; rooting mainly in top 20 inches above pan; moderate available water capacity; seasonal high water table at depth of 18 to 24 inches. WoC, WsC: moderately sloping.	Seasonal high water table at depth of 18 to 24 inches; seepage and siltation problems; highly erodible.	Cut slopes highly erodible; seepage and siltation problems; moderately well drained.

Estimated soil properties significant to engineering

Table 5 lists estimated properties of all of the soils in the county that are significant to engineers. The estimates in table 5 are based on test data shown in table 4, on information taken from the soil survey, and on knowledge gained through experience in using the soils for engineering construction. The estimates in table 5 and interpretations in table 6 generally are to depths of 4 to 5 feet of the named soil series in the mapping units. Also, each soil area (mapping unit) contains small areas of other soils that differ considerably from the soil for which the mapping unit is named. As a consequence, onsite checking of a tentatively selected site for any engineering applications is necessary.

Some of the column headings in table 5 are self explanatory or have been previously discussed. The few that are not are further explained as follows:

The depth to bedrock was based on observations made during the course of the survey. From place to place, the depth to bedrock may vary considerably.

The depth to a seasonal high water table applies to soil conditions in frost-free periods and refers to the highest level at which ground water or a perched water table stands for a significant period of time. Soil conditions immediately after heavy precipitation are not considered.

The depth from surface of a typical profile given in this column was taken from the profile described as representative for the series in this county. These depths reflect significant changes in texture, density, or other soil features that have engineering significance.

Permeability refers to the rate at which water moves through undisturbed soil layers. The rate depends largely on the texture, porosity, and structure of each layer and is expressed in inches per hour. A rate of less than 0.2 inches per hour is slow; 0.2 to 0.63 inches, moderately slow; 0.63 to 2.0 inches, moderate; 2.0 to 6.3 inches, moderately rapid; and more than 6.3 inches, rapid.

Available water capacity is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at the wilting point of plants. When the soil is air dry, this amount of water wets the soil material described to a depth of 1 inch without deeper percolation. A dash in this column indicates that very few or no roots penetrate a particular soil layer.

Soil reaction refers to the degree of acidity or alkalinity of a soil, expressed as pH value of the unlimed soils. In soils that have been used for crops and have received large applications of lime over a period of several years, the reaction is higher in places than the value shown in table 5.

Interpretations of engineering properties

In table 6, soils are given suitability ratings as a source of topsoil, sand, gravel, and fill material and features of soils that affect stated engineering practices. Some of the practices listed in table 6 are those that affect soil and water conservation, such as farm ponds, drainage systems, irrigation, diversion terraces, and waterways. The interpretations given in table 6 provide guidelines for the use of soils in engineering and indicate potential hazards that require unusual procedures or special precautions in planning engineering works.

The suitability of soils as a source of topsoil, granular material, and fill material is rated in table 6 as *good*, *fair*, *poor*, or *unsuitable*.

Topsoil.—The texture, depth, and content of organic matter of the soil were used mainly in determining the suitability ratings for topsoil. For example, a soil is rated *good* if it has a silt loam or loam texture, is free of rock fragments, and is high in organic-matter content. In contrast, a clayey soil or one that contains many rock fragments is rated *unsuitable*. Medium-textured soils that formed in alluvium generally are the most suitable as a source of topsoil.

Granular material.—The suitability of soils for granular material (sand and gravel) depends mainly on the texture and arrangement of the material in the substratum. Well-sorted glacial outwash and some alluvial material are the best sources of sand and gravel in Wyoming County. The quality of the deposit is not indicated by the suitability rating.

Fill material.—Fill material is used mainly in dams, pavement bases, highway embankments, parking lots, and similar structures. The selection of fill material should be determined by the use. The more important soil features to be considered are texture, stoniness, permeability, compressibility, shrink-swell potential, organic-matter content, and moisture content.

Highway location.—The more important features that influence the location of highways are texture, organic-matter content, permeability, drainage, compressibility, slope, depth to bedrock, hazard of flooding, strength, stability after compaction, and shrink-swell potential. Most soils on uplands have a dense, slowly permeable fragipan or dense till layer in the lower part. Where possible, the gradeline should be planned to avoid cutting into or out of these layers.

Embankment foundation.—Among the more important soil features that determine the use of soils as embankment foundations are texture, strength, compressibility, stability, drainage, and depth to bedrock. Most soils that formed in deep glacial till provide good embankment foundations, but those that formed in glacial outwash, lacustrine sediment, and alluvium are variable. Peat and muck are unsuitable and should be avoided if possible.

Foundations for low buildings.—Among the features that affect use of soils for foundations are drainage, slope, hazard of flooding, strength, susceptibility to frost action, and shear strength. If foundations for large buildings are to be constructed, a detailed subsurface investigation is necessary and design needs to be based on the investigation. A general subsurface investigation is sufficient in places for residences and light commercial buildings. Basement seepage is the main concern in building foundations on soils of Wyoming County. In most places foundation drains and proofing against dampness and seepage are necessary.

Farm ponds.—The reservoir area of ponds depends on the ability of the soil to hold water. Except in areas where the water table is near the surface, rapidly permeable material, such as sand and gravel, generally has severe limitations as reservoir areas. Most soils that formed in glacial till have impeded permeability and are suitable, but in places they have sandy or gravelly layers that allow excessive seepage. Embankments for the impoundment of water depend on the ability of compacted soil material to stop the flow of water. Poorly graded sandy and silty material disperse readily and are subject to piping. These materials should be avoided when building embankments.

Agricultural drainage.—The main soil features that affect agricultural drainage are texture, permeability, height of the water table, depth to bedrock, slope, stability, and the hazard of flooding. In Wyoming County most poorly drained soils on uplands have a dense fragipan or panlike layer that retards the movement of water. Both surface and subsurface interception drains are needed in places. Lenses of sand and gravel are in some soils that formed in glacial till. These lenses cause piping and instability of drainage structures. Soils that formed in water-laid material contain layers of poorly graded silt, fine sand, or sand in places. These layers adversely affect open ditches and subsurface drains. Unless subsurface drains in these soils are protected, they become plugged with silt and fine sand in places.

Irrigation.—The main soil features that affect irrigation are drainage, permeability, infiltration rate, available water capacity, thickness of the root zone, slope, and erodibility. Soils that formed in gravelly or sandy glacial outwash generally are droughty and have moderate to low available water capacity. Some soils that formed in glacial till and soils that are shallow to bedrock have layers near the surface that impede the movement of water and restrict penetration by roots. If sloping areas of erodible soils are irrigated, erosion-control measures are needed.

Diversions.—The important features that affect the building of diversions are slope, permeability, depth to bedrock or other impervious material, stability, and erodibility. If diversions are built in soils that have a slowly permeable layer, the diversions should be deep enough to prevent seepage along the top of the layer. In places piping occurs where sandy or silty layers are cut during the building of diversions, and these layers are also subject to eroding, sloughing, and slumping.

Waterways.—The same soil features that affect diversions also affect waterways. Where waterways are constructed in soils having a shallow, slowly permeable layer, prolonged seepage is likely to occur. This seepage makes the establishment and maintenance of protective vegetation difficult.

Engineering significance of geologic deposits in which soils have formed

Soils in Wyoming County formed in deposits resulting from various geologic processes. Some deposits are well-graded mixtures of various textures, and others are single grained. Some are very loose; others are extremely compact. Drainage conditions vary. Some deposits are permanently wet, and others are very dry for a considerable part of the year. Some support heavy loads with negligible settlement or deformation; others require extensive treatment to support even light fills or light buildings.

The soils of the county can be placed into categories that, on a broad basis, have significant engineering differences. The Soil Mechanics Bureau of the New York State Department of Transportation uses the depositional unit basis as the first broad separation of the soils. In Wyoming County all the soils have been placed in the following depositional categories: Deep glacial till, thin glacial till, glacial outwash, lacustrine sediment, old alluvium, recent alluvium, organic deposits, and the miscellaneous land type Rock outcrop.

DEEP GLACIAL TILL

Glacial till deposits formed in soil and rock fragments that were picked up, transported, abroad, mixed, and deposited by the action of glacial ice. The resulting deposits are highly variable assortments of soil and rock material. The particle size ranges from ledgy rock fragments and large boulders to clay. Stratification generally does not occur, but stratified areas are in some places. These areas can be interstratified sand and gravel or they can be pockets of silt and clay. Also, where ice advances occurred in waves, bed-on-bed deposits of till occurred. In these areas some pseudo-stratification is present, and contiguous beds often have a different texture.

Most of the till deposits of the county have been subjected to the compactive weight of overriding ice and are very dense and compact. The deposits laid down during ablation stages or down-wasting and back-wasting periods of glaciation generally are not so dense, because they have not been overridden. Some of these deep till deposits are overlain by a thin mantle of windblown or water-laid silt, very fine sand, or clay. Deep till deposits in this county generally are 3½ feet thick or more over bedrock.

Soils of the Alden, Appleton, Bath, Conesus, Danley, Darien, Ellery, Erie, Fremont, Ilion, Langford, Lansing, Lyons, Madrid, Mardin, Marilla, and Volusia series formed mainly in the dense basal till.

Very few of the deposits occupy flat areas. Soils range mainly from gently sloping to very steep, and the terrain is such that cut and fill earthwork is involved in most construction.

Based on results from a limited number of tests in place, density of the C horizon of soils that formed in these till deposits ranges from 111 pounds per cubic foot to 129 pounds per cubic foot, as determined by ASTM Designation D1556. Maximum density ranges from 120 pounds per cubic foot to 133 pounds per cubic foot, as determined by compaction tests conducted in accordance with the procedures of AASHO (2) Designation T–99, Method C. Natural moisture content ranges from 7 percent to 16 percent, and optimum moisture content for compaction ranges from 8.4 pecent to 16.4 percent. Test results are from samples obtained from relatively shallow depths. Deep cuts in these till deposits encounter bedrock in places, especially where areas of deep till are adjacent to areas of thin till.

For highway engineering purposes, earthwork involves both longitudinal and sidehill cuts and fills. In the well-drained soils that formed in dense tills, cuts are fairly stable if properly designed, and subgrades generally are satisfactory. Sloughing on cut slopes, associated with frost withdrawal or large amounts of runoff, are exceptions to this. The compact condition of the till impedes infiltration, and runoff causes severe sloughing if the water is not intercepted. These till deposits furnish good embankment sites if they are not too steep. They are also the source of fill material for embankments. Large stones and boulders that interfere with fill placement in thin lifts are in places.

For residential developments, the sloping till deposits need a considerable amount of grading. The compact, impervious nature of the deposits imposes some difficulties if sewage disposal is by way of septic tanks and septic fields. If the stone content is high, stones in lawns and athletic fields are hazardous to mowing equipment and personnel.

Soils of the Burdett, Canaseraga, Dalton, Nunda, and Sun series formed in veneers of windblown or water-laid silts or very fine sands that are 20 to 40 inches thick over the dense basal till. Churchville soils have a lacustrine silt and clay mantle, which is 20 to 36 inches thick over the till. The density and drainage between these contrasting deposits varies consideraby so that shallow cuts and fills involve nonuniform soil conditions, and they are subject to differential frost heave. Otherwise, these soils behave much the same as those that formed in dense basal till.

During the ablation or wasting stages of glaciation, comparatively loose till deposits were left in place and are closely associated with deposits of dense basal till and crudely sorted to well-sorted deposits of gravelly and sandy glacial outwash. Soils of the Valois series and some soils of the Madrid series formed in these ablation or morainic tills. The Valois soils make up a soil complex with Bath soils on dense till in these situations, and the Madrid soils are in a complex with Howard soils on glacial outwash. These deposits generally are on undulating to rolling landscapes with short slopes and are comparatively easy to recognize. These mixed deposits require the greatest amount of subsurface investigation to determine their engineering properties. The subgrade in cuts, especially the outwash materials, are subject to severe differential frost heave.

THIN GLACIAL TILL

This material is similar to deep glacial till, but the depth to bedrock generally is less than 3½ feet. Except for a few places, the till is weathered, and the relatively less dense material of the solum extends to the bedrock. Rock fragments are common in the soil mass. In light grading operations bedrock generally is encountered in cuts.

Soils of the Angola, Aurora, Arnot, Hornell, Lordstown, Manlius, and Tuller series formed in thin glacial till. The Angola, Aurora, Hornell, and Manlius soils are underlain by shale that generally can be broken with heavy equipment; however, layers of more resistant sandstone or siltstone are in places. The Arnot, Lordstown, and Tuller soils are underlain by sandstone or siltstone.

Thin till generally is satisfactory as an embankment foundation for highway fills because the soil thickness is so slight that little soil settlement can occur. The rocks are relatively unyielding. Some of the soils are very steeply sloping, however, and in places shear keys are needed to prevent fills from sliding.

These thin till areas have limitations for residential use. In places basement excavations encounter the underlying bedrock; basement seepage is a hazard; and facilities associated with developments, such as sewer installations, water, and gaslines, involve rock excavation. Sewage disposal by septic-tank systems is difficult, and special design is needed in places.

Thin till material can be used for highway fill. If fill material taken from cuts includes both the soil and the underlying bedrock, it is difficult to place it in layers that are thin enough to attain good compaction. This holds true even if the most standard compaction equipment is used, especially if the blasted rock fragments are too large for thin lifts. If only the soil is used, the volume per acre is small.

Part of the thin glacial till deposits are relatively flat. In places in these areas, a moderately elevated grade line eliminates the need for blasting the underlying bedrock to dig drainage ditches.

Where highway cuts and fills are made, there is a definite need for transition sections. In places highway slopes involve a combination of soil and rock cuts, and the slope of the soil generally must be flatter than that of the rock. Sloughing at the soil-rock interface is common. High rock slopes require special design in places, depending on the structure of the rock and its weathering characteristics. Refer to literature on bedrock geology for additional information.

These soils are not sources for granular material, and the underlying rocks are not good for coarse aggregates.

GLACIAL OUTWASH

These deposits consist mainly of sorted sand and gravel deposited by glacial melt water. They are on such geologic landforms as outwash terraces, eskers, valley trains, kames, kame terraces, kame moraines, and outwash fans. Many of the deposits, especially those on deltas and outwash fans, are underlain by or contain lenses of silt and clay strata which impede drainage.

The soils of the Castile, Chenango, Herkimer, Homer, Howard, Palmyra, Phelps, and Red Hook series formed in glacial outwash.

Depending on soundness, plasticity, and gradation, outwash can be used for such purposes as fill material for highway embankments; fill material for parking areas and developments; fill material to decrease stress on underlying soils so construction operations can progress; subbase for pavements; wearing surfaces for driveways, parking lots, and low-class roads; materials for highway shoulders; granular backfill for structures and pipes; and outside shells of impounding dams. Outwash is unsuited for use as fill material for impervious parts of dams; as an abrasive for snow and ice control on highways; as a slope protection blanket to drain some wet slopes; as a granular blanket to prevent pumping under concrete pavements; and as a source of aggregates for concrete.

Deposits in which shaly soils of the Herkimer and Howard series and channery fans of the Chenango and Castile series formed generally lack the soundness and gradation necessary for most of the above-mentioned uses, except for subsurface fills (fig. 13).

If well drained, some outwash deposits on extensive flat terraces and deltas furnish excellent locations for highways and other developments. Granular material is commonly underlain by wet silt and clay that is soft and weak. Thus, the underlying material needs to be considered at all sites of proposed heavy fills and structures. Kames and kame moraines require considerable grading for highways and other facilities. These steep-sided granular deposits have excellent surface drainage, but silt strata that retard internal drainage are in all types of outwash deposits. If these silt strata are intercepted by a highway gradeline or are near the top of the subgrade in cuts, differential frost heaving occurs. For highways and other paved areas, undercutting is necessary in places to prevent such frost heaving and to provide uniform subgrade support. Cuts in these materials are dry in places during periods of construction, and it is difficult to foresee the potentially adverse moisture conditions that develop in wet periods.

Figure 13.—**Profile of a Howard shaly silt loam showing outwash material below plow layer.**

Figure 14.—**Rilling in a Collamer soil.**

LACUSTRINE SEDIMENT

Glacial lakes occupied some of the valleys in the county for a long period. Stone-free glacial melt water deposits in these lakes are called lacustrine sediment. In Wyoming County these deposits range in texture from fine sand to silt and clay.

Soils of the Arkport series formed in sandy sediment and commonly occupy deltas or duney areas. Soils of the Collamer, Niagara, Wallington, and Williamson series formed in silty and very fine sandy deposits and those of the Caneadea and Canadice series formed in clay and silt deposits. Also in this category are soils of the Varysburg series and a clay substratum soil of the Homer series. The Varysburg soil consists of 20 to 40 inches of gravelly outwash or ablation till underlain by lacustrine clay, and the Homer soil consists of 5 to 10 feet of gravelly outwash underlain by lacustrine clay and silt. These soils were included because many of the engineering uses are affected by the presence of this subsurface lacustrine material.

Areas of lacustrine sediment consist of nearly level to steep soils on dissected terraces. These materials are highly erodible, even on slight grades (fig. 14). If they are on steep fronts of terraces, erosion is severe. Also, landslides are numerous on the clayey deposits. Except for the sandy Arkport soils, infiltration is restricted. If they are nearly level, runoff is very slow. Wetness generally increases with increasing depth, and experience has shown that some deposits have a natural moisture content of as much as 60 or 70 percent. The optimum moisture content for silty-clayey soils ranges from 10 to 20 percent. Therefore, a predetermination of moisture content is needed before the use of this material for borrow is considered.

Because these soils are weak and drainage is often difficult, lacustrine sediment is more difficult to use in engineering work than any other mineral soil material in the county. Highway gradelines must be kept high; and sites for high embankments and heavy buildings must be investigated thoroughly for strength, settlement characteristics, and height of the water table. This sediment is highly susceptible to frost action, and it loses strength seasonally when the moisture content is increased by thawing. It is difficult to work when wet. A base course of granular material is needed beneath highway pavements and parking lots. If crushed stone or gravel is used as a base course, consideration must be given to use of a course of sand as a filter under the gravel or stone. This filter prevents the movement of the fine-textured lacustrine sediment into the base course.

A blanket of granular material can be used on cut slopes to prevent sloughing, or the cuts can be made less sloping. In building embankments the moisture content of the clayey material should be carefully controlled. In most places foundations are poor, and much settlement occurs under heavy loads and structures. Foundations of bridges and buildings generally require piles for support unless the loads are light. During wet periods it is difficult for mobile equipment and other vehicles to pass over these fine-textured soils.

OLD ALLUVIUM

These deposits occupy glacial stream terraces along some of the larger valleys. They consist of silt and very fine sand deposits underlain by gravelly and sandy glacial outwash.

Soils of the Allard and Scio series formed in these deposits. The thickness of the silt and very fine sand mantle over the gravelly material ranges from about 20 to 40 inches in the Allard soil and from about 40 inches to 6 feet in the Scio soil.

For engineering uses the silty veneer behaves much the same as silty lacustrine sediment and the gravelly substratum much like glacial outwash. Also in some places, especially on deltas, Scio soils flood infrequently.

RECENT ALLUVIUM

These deposits consist of strata of sediment of varying texture deposited on the flood plains of streams.

Alluvial land and soils of the Hamlin, Papakating, Teel, Tioga, Wallkill, and Wayland series formed in recent alluvium.

These alluvial deposits have a fluctuating but generally shallow water table, and they are subject to annual or, in places, more frequent periods of flooding. In places these areas are underlain by soft, wet, compressible lacustrine sediment or by muck.

Even light cuts encounter a water table and, therefore, cuts generally are not practical. Because the areas are subject to flooding, the gradeline should be above flood elevation.

Areas of alluvium generally are poor for foundations. Thorough investigation and, in some locations, special analysis and design are needed before foundations for bridges and high embankments are constructed on these soils.

Deposits of alluvium are subject to flooding, and they should be avoided when seeking a building site. The hazard of flooding and the elevation of the water table must be evaluated carefully before these areas are considered for any building purposes.

Most deposits of alluvium are good potential sources of topsoil.

ORGANIC DEPOSITS

Organic deposits are formed by the accumulation of plant and animal remains. They are in poorly drained, depressional areas. Palms muck is the only soil that formed in organic deposits in Wyoming County.

Organic deposits are unsuitable for highway or other embankment sites or for building foundations because they are highly compressible and unstable. Organic deposits and any other unsuitable material underlying highways generally should be removed and replaced by suitable backfill. Backfill below the water table should be made with broken rock or granular material. The gradeline in these areas must be above the high water elevation. Organic soils can be used to amend the unsatisfactory physical conditions of both sandy and clayey soils if they are to be used as topsoil.

ROCK OUTCROP

Rock outcrop is a miscellaneous land type of very steep rocky areas. The areas are gorges mostly along the Genesee River. Typically the area is a gorge that has rock outcrops on the steep slopes, a talus slope at the bottom, and glacial till or some other soil deposit above the rock slopes. These areas have no practical use.

Winter embankment construction

During freezing weather, much greater compactive effort is required to obtain the minimum acceptable degree of compaction of soils. As the temperature falls below 20° to 25° F., it becomes virtually impossible to attain a satisfactory degree of density using standard compaction equipment, even if the soil material is relatively clean sand and gravel. Highway embankments constructed during periods of freezing generally settle unevenly for a period of years, and, consequently, the pavement becomes rough. Winter work on construction of embankments, therefore, should be limited to the placement of rock fills. The surface of partly constructed embankments that are left exposed in winter should be crowned and rolled smooth to shed water and prevent infiltration.

Frost effects in soils as related to construction

All of the soils in Wyoming County are subject, in varying degrees, to the effects of freezing and thawing of water on soil and rock material and the structures founded on it. As a consequence, measures to combat frost damage generally are needed for all types of engineering construction.

Two types of frost heave occur. One is uniform heave, and the other is differential heave. Uniform heave occurs where soil texture and ground water conditions are uniform, such as in the silty lacustrine deposits in which the Williamson and Collamer soils formed. Differential heave occurs (1) where the soil texture varies in contiguous strata; (2) at cut and fill transitions when an available source of ground water is close to the surface; or (3) in those soils that contain various sized rock fragments in the frost zone, especially those greater than 10 inches in diameter. Differential heave also occurs where lateral drains, culverts, and approach fills to bridges and overpasses break the uniformity of subgrade conditions. Differential heave is most serious in nonuniform, stratified, gravelly outwash deposits in which such soils as Howard, Phelps, and Chenango formed. Large rock fragments that cause "boulder heaves" are commonly found in soils formed in the glacial till deposits of the uplands, such as Mardin and Volusia soils. Differential frost heave, in contrast to uniform heave, produces more pavement stressing and surface roughness.

The freezing and thawing effect on all soils in the county causes deterioration of thin pavements and unpaved roads as well as loss of density of supporting soils. On cut slopes it causes soil creep and displacement of cobblestones and stones. It also causes weathering and dislodging of rock in rock cuts. During periods of thawing, there is a loss of subgrade support, and drainage is restricted by the still unfrozen layer.

Town and Country Planning

This section is of special interest to developers, planners, and others who are concerned with community and industrial expansion in Wyoming County. It is also of interest to those concerned with the encroachment of this urban expansion into farming areas.

Table 7 gives ratings for the limitation of soils used for disposal of septic tank effluent at homesites, picnic areas, camping sites, and other community development and recreational uses. The table lists the soils of the county and shows the kind of limitations of the soils if they are used for certain community development and recreational purposes. Normally, soil investigations for this survey did not extend below a depth of 3½ to 5 feet, and small spots of soils that differ from the dominant soil for which the mapping unit was named were included in mapping. As a

consequence, onsite inspection is needed for most uses, especially those that require deep excavations.

The major properties that affect the nonfarm uses of soils are slope; drainage or depth to seasonal high water table; soil permeability, or the rate at which water moves through the soil; stoniness, or the content of stones 10 inches or more in diameter; surface texture, or particle-size (sand, silt, clay, gravel, channery fragments and cobblestone) distribution; the presence of hard bedrock, which generally requires blasting before it can be removed; the presence of soft bedrock, which generally can be removed with power tools; and the hazard of flooding and ponding.

In table 7, the limitations of the soils are rated *slight*, *moderate*, or *severe*. If the rating is *moderate* or *severe*, the chief limitations for the specified use are listed. A rating of *slight* indicates that the soil has few limitations, if any, and is considered desirable for the use named. A rating of moderate shows that a moderate limitation is recognized, but that it can be overcome or corrected. A rating of *severe* indicates that the use of the soil is seriously limited by a hazard or restriction that is difficult to overcome. A rating of severe does not imply that a soil so rated cannot be used for the stated purpose. Also, it should be recognized that large-scale cuts or fills in an area can alter the natural soil so much that the rating given in the table no longer applies.

No single property restricts all types of nonfarm uses equally. For example, a seasonal high water table that is a moderate limitation for many uses can severely limit the use of the soil for the disposal of septic tank effluent. The uses rated in table 7 are explained in the following paragraphs.

Homesites.—Soils are rated for homes or other buildings of three stories or less, with basements. The features considered in rating are depth to a seasonal or prolonged high water table, slope, depth to bedrock, stoniness, and hazard of flooding. For buildings without basements, depth to bedrock and a water table are less restrictive. Also, slope is considered mainly for subdivision development. It is less of a restriction for isolated buildings.

Limitations of sewage disposal, water supply, stabilizing or maintaining vegetative cover, or access roads are not considered in the homesite rating. Other engineering properties of soils that are pertinent, such as compressibility and strength, are referred to in the engineering section of this survey.

Specific location of buildings generally requires an onsite investigation.

Septic Tank Filter Fields.—It is assumed that the soils are to be used as drainage fields for disposal of effluent from adequately designed and installed septic tank systems. Source of water, whether from individual or community systems, is not a consideration in the ratings, although if there is a possible pollution hazard to wells, springs, or lakes, footnotes are shown where pertinent. Specific location of drainage fields for disposal of effluent requires onsite investigation.

Among the major soil properties influencing the use are permeability, depth to seasonal or prolonged high water table, depth to bedrock, slope, stoniness, and hazard of flooding or ponding.

Streets and Parking Lots.—Soil requirements for streets and parking lots are similar to those for highways. In rating the soils, the main features considered are depth to a seasonal or prolonged high water table, slope, depth to bedrock, stoniness, and hazard of flooding.

Tables 5 and 6 and the text of the section "Engineering Uses of the Soils" provide other pertinent information, such as stability of cut slopes, subgrade conditions, source of fill material, and other items. Specific layout requires onsite investigation.

Pipeline Installations.—The choice of a soil suitable for the installation of an underground pipeline is determined mainly by the depth to hard bedrock, slope, content of large stones, natural drainage, and soil stability. Limitations are severe on the Lordstown, Arnot, and Tuller soils because of the relatively shallow depth to hard, massive sandstone bedrock. Other soils, such as Aurora, Angola, Hornell, and Manlius, have a moderate limitation because of the relatively shallow depth to rippable shaly bedrock.

Many soils are steep, and several of them have irregular slopes. These latter soils are in the Arkport, Caneadea, Chenango, Collamer, Howard, and Valois series. The installation of pipelines is difficult in these areas. Arkport, Caneadea, and Collamer soils are unstable. Several soils formed in glacial till on uplands, such as Bath, Mardin, or Volusia, are likely to have large flat stones in the substratum. These stones interfere with trench excavation.

Lawns, Landscaping, and Golf Fairways.—Among the soil properties that determine the suitability of soils for lawns and golf fairways are depth to a seasonal or prolonged high water table, slope, depth to bedrock, surface texture, stoniness, and hazard of flooding. No importation of fill or topsoil is considered in the ratings, and traps or roughs are not considered as part of the fairway. Deep, well drained or moderately well drained soils that have a medium-textured or moderately coarse textured surface layer and that are no more than moderately sloping are well suited to these uses.

Campsites.—Soil areas are rated for use as tent or small trailer campsites for large numbers of people. Frequent use during the camping season involving heavy foot and limited vehicular traffic is assumed. Problems of sewage disposal, water supply, and access roads were not considered in the development of these ratings. It is assumed that little site preparation is to be done other than shaping and leveling tent and parking areas. The major soil properties considered are depth to seasonal high water table, permeability, slope, stoniness, surface texture, and hazard of flooding or ponding during the period of heavy use.

Picnic Areas.—Soils are rated for park-type picnic areas with provisions for tables and fireplaces for large numbers of people. It is assumed that most vehicular traffic is confined to access roads. These areas are left essentially in their natural state. Problems of water supply and sewage disposal are not considered in the rating. The soil properties considered are depth to seasonal high water table, slope, depth to bedrock, surface stoniness, surface texture, and the hazard of flooding during the period of heavy use.

Athletic Fields.—The soils are rated for developing areas for intensive use for baseball, football, tennis, and similar sports. Areas selected for these uses must be nearly level, have good drainage, and have a favorable surface texture. Importation of fill material or topsoil was not considered in developing the ratings.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Alden mucky silt loam	Severe: prolonged high water table at surface; ponding in places.	Severe: prolonged high water table at surface; ponding in places.	Severe: prolonged high water table at surface; ponding in places.
Allard silt loam, 0 to 3 percent slopes.	Slight	Slight: hazard of pollution	Slight
Allard silt loam, 3 to 8 percent slopes.	Slight	Slight: hazard of pollution	Moderate: 3 to 8 percent slopes.
Allard silt loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; very erodible.	Moderate: 8 to 15 percent slopes; hazard of pollution.	Severe: 8 to 15 percent slopes
Alluvial land	Severe: subject to frequent flooding; seasonal high water table.	Severe; subject to frequent flooding; seasonal high water table.	Severe: subject to frequent flooding; seasonal high water table.
Angola shaly silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ foot; rippable bedrock at depth of 1½ to 3½ feet.	Severe: slow permeability; seasonal high water table at depth of ½ foot; rippable bedrock at depth of 1½ to 3½ feet.	Severe: seasonal high water table at depth of ½ foot; ponding in places; rippable bedrock at depth of 1½ to 3½ feet.
Angola and Aurora shaly silt loams, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.	Severe: slow permeability; seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.
Appleton gravelly silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ foot.	Severe: moderately slow to slow permeability; seasonal high water table at depth of ½ foot.	Moderate: seasonal high water table at depth of ½ foot.
Appleton gravelly silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ foot.	Severe: moderately slow to slow permeability; seasonal high water/table at depth of ½ foot.	Moderate: seasonal high water table at depth of ½ foot.
Arkport very fine sandy loam, 2 to 8 percent slopes.	Slight	Slight: hazard of pollution in places.	Slight
Arkport very fine sandy loam, 8 to 15 percent slopes.	Slight to moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate to severe: 8 to 15 percent slopes.
Arkport very fine sandy loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Arkport very fine sandy loam, 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.
Arnot channery silt loam, 2 to 8 percent slopes.	Severe: bedrock at depth of 1 to 1½ feet.	Severe: bedrock at depth of 1 to 1½ feet.	Severe: bedrock at depth of 1 to 1½ feet.

for town and country planning

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Moderate: prolonged high water table at surface; ponding in places.	Severe: prolonged high water table at surface; ponding in places.	Severe: prolonged high water table at surface; ponding in places.	Severe: prolonged high water table at surface; ponding in places.	Severe: prolonged high water table at surface; ponding in places.
Slight	Slight	Slight	Slight	Slight.
Slight	Slight	Slight	Slight	Moderate: 3 to 8 percent slopes.
Moderate: unstable very fine sand and silt.	Moderate: 8 to 15 percent slopes; very erodible.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Severe: subject to frequent flooding; seasonal high water table.	Severe: subject to frequent flooding; seasonal high water table.	Severe: subject to frequent flooding; seasonal high water table.	Severe: subject to frequent flooding; seasonal high water table.	Severe: subject to frequent flooding; seasonal high water table.
Severe: seasonal high water table at depth of ½ foot; rippable bedrock at depth of 1½ to 3½ feet.	Severe: seasonal high water table at depth of ½ foot; ponding in places; rippable bedrock at depth of 1½ to 3½ feet.	Severe: seasonal high water table at depth of ½ foot.	Moderate: seasonal high water table at depth of ½ foot.	Severe: seasonal high water table at depth of ½ foot; slow permeability; rippable bedrock at depth of 1½ to 3½ feet.
Generally moderate, but seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow permeability; rippable bedrock at depth of 1½ to 3½ feet.
Generally slight, but seasonally severe because of high water table at depth of ½ foot.	Moderate: seasonal high water table at depth of ½ foot; gravelly surface layer.	Severe: moderately slow to slow permeability; seasonal high water table at depth of ½ foot.	Moderate: seasonal high water table at depth of ½ foot.	Severe: moderately slow to slow permeability; seasonal high water table at depth of ½ foot; gravelly surface layer.
Moderate: seasonal high water table at depth of ½ foot.	Moderate: seasonal high water table at depth of ½ foot; gravelly surface layer.	Severe: moderately slow to slow permeability; seasonal high water table at depth of ½ foot.	Moderate: seasonal high water table at depth of ½ foot.	Severe: moderately slow to slow permeability; seasonal high water table at depth of ½ foot; gravelly surface layer.
Moderate: unstable very fine sand and silt.	Slight	Slight	Slight	Moderate: 2 to 8 percent slopes.
Moderate: unstable very fine sand and silt.	Slight to moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Moderate: 15 to 25 percent slopes; unstable very fine sand and silt.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe; 25 to 40 percent slopes.
Severe: bedrock at depth of 1 to 1½ feet.	Severe: bedrock at depth of 1 to 1½ feet.	Moderate: channery surface layer.	Moderate: channery surface layer.	Severe: bedrock at depth of 1 to 1½ feet; channery surface layer.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Arnot channery silt loam, 8 to 15 percent slopes.	Severe: bedrock at depth of 1 to 1½ feet; 8 to 15 percent slopes; many rock outcrops.	Severe: bedrock at depth of 1 to 1½ feet; many rock outcrops.	Severe: bedrock at depth of 1 to 1½ feet.
Aurora shaly silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ feet; rippable bedrock at depth of 1½ to 3½ feet; 8 to 15 percent slopes.	Severe: slow permeability; rippable bedrock at depth of 1½ to 3½ feet.	Severe: 8 to 15 percent slopes.
Bath channery silt loam, 0 to 3 percent slopes.	Slight	Severe: slow permeability at depth of 18 to 34 inches.	Slight
Bath channery silt loam, 3 to 8 percent slopes.	Slight	Severe: slow permeability at depth of 18 to 34 inches.	Moderate: 3 to 8 percent slopes.
Bath channery silt loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: slow permeability at depth of 18 to 34 inches.	Severe: 8 to 15 percent slopes.
Bath channery silt loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; slow permeability at depth of 18 to 34 inches.	Severe: 15 to 25 percent slopes.
Bath channery silt loam, 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes; slow permeability at depth of 18 to 34 inches.	Severe: 25 to 40 percent slopes.
Bath-Valois gravelly loams, 0 to 3 percent slopes.	Slight	Severe in Bath gravelly loam: slow permeability at depth of 18 to 34 inches. Slight in Valois gravelly loam.	Slight
Bath-Valois gravelly loams, 3 to 8 percent slopes.	Slight	Severe in Bath gravelly loam: slow permeability at depth of 18 to 34 inches. Slight in Valois gravelly loam.	Moderate: 3 to 8 percent slopes.
Bath-Valois gravelly loams, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe in Bath gravelly loam: slow permeability at depth of 18 to 34 inches. Moderate in Valois gravelly loam: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Bath-Valois gravelly loams, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe in Bath gravelly loam: 15 to 25 percent slopes; slow permeability at depth of 18 to 34 inches. Severe in Valois gravelly loam: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Burdett silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow permeability and seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Burdett silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow permeability and seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Canadice silty clay loam	Severe: prolonged high water table at surface.	Severe: very slow permeability and prolonged high water table at surface.	Severe: prolonged high water table at surface.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Severe: bedrock at depth of 1 to 1½ feet; many rock outcrops.	Severe: bedrock at depth of 1 to 1½ feet; 8 to 15 percent slopes; many rock outcrops.	Moderate: channery surface layer; 8 to 15 percent slopes; many rock outcrops.	Moderate: channery surface layer; 8 to 15 percent slopes; many rock outcrops.	Severe: bedrock at depth of 1 to 1½ feet; 8 to 15 percent slopes; many rock outcrops; channery surface layer.
Moderate: rippable bedrock at depth of 1½ to 3½ feet.	Moderate: rippable bedrock at depth of 1½ to 3½ feet; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Slight	Moderate: channery surface layer.	Moderate: channery surface layer.	Moderate: channery surface layer.	Severe: 25 to 35 percent flat stones in soil.
Slight	Moderate: channery surface layer.	Moderate: channery surface layer.	Moderate: channery surface layer.	Severe: 25 to 35 percent flat stones in soil.
Slight	Moderate: 8 to 15 percent slopes; channery surface layer.	Moderate: 8 to 15 percent slopes; channery surface layer.	Moderate: 8 to 15 percent slopes; channery surface layer.	Severe: 8 to 15 percent slopes; 25 to 35 percent stones in soil.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; 25 to 35 percent flat stones in soil.
Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes; 25 to 35 percent flat stones in soil.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.
Slight	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Severe: 8 to 15 percent slopes; gravelly surface layer.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; gravelly surface layer.
Generally slight, but seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; moderately slow and slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; moderately slow and slow permeability.
Generally slight, but seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; moderately slow and slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet;	Severe: seasonal high water table at depth of ½ to 1½ feet; moderately slow and slow permeability.
Severe: prolonged high water table at surface; unstable.	Severe: prolonged high water table at surface; very slow permeability; poor trafficability.	Severe: prolonged high water table at surface; very slow permeability; poor trafficability.	Severe: prolonged high water table at surface; poor trafficability.	Severe: prolonged high water table at surface; slow permeability; poor trafficability.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Canaseraga silt loam, 0 to 3 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2½ feet.	Severe: slow permeability at depth of 1½ to 2½ feet	Moderate: seasonal high water table at depth of 1½ to 2½ feet.
Canaseraga silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2½ feet.	Severe: slow permeability at depth of 1½ to 2½ feet.	Moderate: seasonal high water table at depth of 1½ to 2½ feet; 3 to 8 percent slopes.
Canaseraga silt loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: slow permeability at depth of 1½ to 2½ feet.	Severe: 8 to 15 percent slopes.
Caneadea silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of 1 foot.	Severe: slow or very slow permeability; seasonal high water table at depth of 1 foot.	Moderate: seasonal high water table at depth of 1 foot.
Caneadea silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of 1 foot.	Severe: slow permeability; seasonal high water table at depth of 1 foot.	Severe: 3 to 8 percent slopes.
Caneadea silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1 foot.	Severe: slow or very slow permeability; seasonal high water table at depth of 1 foot.	Severe: 8 to 15 percent slopes.
Caneadea silty clay loam, 15 to 25 percent slopes, eroded.	Severe: 15 to 25 percent slopes.	Severe: slow or very slow permeability; 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Caneadea silty clay loam, 25 to 50 percent slopes, eroded.	Severe: 25 to 50 percent slopes.	Severe: slow or very slow permeability; 25 to 50 percent slopes.	Severe: 25 to 50 percent slopes.
Castile gravelly loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; hazard of pollution.	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Castile gravelly loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; hazard of pollution.	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Castile channery silt loam, fans, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; hazard of pollution.	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Chenango gravelly loam, 0 to 3 percent slopes.	Slight	Slight: hazard of pollution	Slight
Chenango gravelly loam, 3 to 8 percent slopes.	Slight	Slight: hazard of pollution	Moderate: 3 to 8 percent slopes.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Slight	Slight	Moderate: seasonal high water table and slow permeability at depth of 1½ to 2½ feet.	Slight	Moderate: slow permeability and seasonal high water table at depth of 1½ to 2½ feet.
Slight	Slight	Moderate: seasonal high water table and slow permeability at depth of 1½ to 2½ feet.	Slight	Moderate: slow permeability and seasonal high water table at depth of 1½ to 2½ feet; 3 to 8 percent slopes.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Severe: poor stability in subsoil and substratum; seasonal high water table at depth of 1 foot.	Moderate: seasonal high water table at depth of 1 foot.	Severe: seasonal high water table at depth of 1 foot; slow or very slow permeability.	Moderate: seasonal high water table at depth of 1 foot.	Severe: seasonal high water table at depth of 1 foot; slow or very slow permeability.
Severe: poor stability in subsoil and substratum; seasonal high water table at depth of 1 foot.	Moderate: seasonal high water table at depth of 1 foot.	Severe: seasonal high water table at depth of 1 foot; slow or very slow permeability.	Moderate: seasonal high water table at depth of 1 foot.	Severe: seasonal high water table at depth of 1 foot; slow or very slow permeability.
Generally moderate: poor stability in subsoil and substratum; seasonally severe because of high water table at depth of 1 foot.	Moderate: 8 to 15 percent slopes; poor trafficability; poor workability of surface layer.	Severe: slow or very slow permeability; poor trafficability; 8 to 15 percent slopes; seasonal high water table at depth of 1 foot.	Moderate: 8 to 15 percent slopes; poor trafficability; seasonal high water table at depth of 1 foot.	Severe: slow or very slow permeability; 8 to 15 percent slopes; seasonal high water table at depth of 1 foot.
Moderate: poor stability in subsoil and substratum; seasonally severe because of high water table at depth of 1 foot.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes
Severe: 25 to 50 percent slopes.	Severe: 25 to 50 percent slopes.	Severe: 25 to 50 percent slopes.	Severe: 25 to 50 percent slopes.	Severe: 25 to 50 percent slopes.
Generally slight, but seasonally severe because of high water table at depth of 1½ to 2 feet.	Moderate: gravelly surface layer.	Moderate: seasonal high water table at depth of 1½ to 2 feet; gravelly surface layer.	Moderate: seasonal high water table at depth of 1½ to 2 feet; gravelly surface layer.	Severe: gravelly surface layer.
Generally slight, but seasonally severe because of high water table at depth of 1½ to 2 feet.	Moderate: gravelly surface layer.	Moderate: seasonal high water table at depth of 1½ to 2 feet; gravelly surface layer.	Moderate: seasonal high water table at depth of 1½ to 2 feet; gravelly surface layer.	Severe: gravelly surface layer.
Generally slight, but seasonally severe because of high water table at depth of 1½ to 2 feet.	Moderate: channery surface layer.	Moderate: seasonal high water table at depth of 1½ to 2 feet; channery surface layer.	Moderate: seasonal high water table at depth of 1½ to 2 feet; channery surface layer.	Severe: channery surface layer.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: more than 35 percent gravel and cobblestones.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: 35 percent stone content; 3 to 8 percent slopes.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Chenango gravelly loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; hazard of pollution.	Severe: 8 to 15 percent slopes
Chenango gravelly loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; hazard of pollution.	Severe: 15 to 25 percent slopes.
Chenango channery silt loam, fans, 3 to 8 percent slopes.	Moderate: hazard of flooding in places.	Slight: hazard of pollution	Moderate: 3 to 8 percent slopes; hazard of flooding in places.
Churchville silt loam, 2 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at a depth of ½ to 1½ feet; 2 to 8 percent slopes.
Churchville silt loam, 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Severe: 8 to 15 percent slopes
Collamer silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ feet.	Severe: moderately slow permeability.	Moderate: seasonal high water table at depth of 1½ feet; 3 to 8 percent slopes.
Collamer silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ feet; 8 to 15 percent slopes.	Severe: moderately slow permeability.	Severe: 8 to 15 percent slopes
Collamer silt loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; cuts very erodible; cut slope slippage.	Severe: moderately slow permeability; 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Conesus gravelly silt loam, 0 to 3 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: very slow or slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Conesus gravelly silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: very slow or slow permeability	Moderate: seasonal high water table at depth of 1½ to 2 feet; 3 to 8 percent slopes.
Conesus gravelly silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 8 to 15 percent slopes.	Severe: very slow or slow permeability.	Severe: 8 to 15 percent slopes.
Dalton silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow or very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Slight	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Severe: more than 35 percent gravel and cobblestone; 8 to 15 percent slopes.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: more than 35 percent gravel and cobblestone; 15 to 25 percent slopes.
Slight	Moderate: channery surface layer.	Moderate: surface layer.	Moderate: hazard of flooding in places; channery surface layer.	Severe: channery surface layer.
Moderate: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow permeability.
Moderate: seasonal high water table at depth of ½ to 1½ feet; poor trafficability when wet; seasonally severe because of wetness.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: Seasonal high water table at depth of ½ to 1½ feet; slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow permeability; 8 to 15 percent slopes.
Moderate: unstable very fine sand and silt.	Slight	Moderate: seasonal high water table at depth of 1½ feet; moderately slow permeability.	Slight	Moderate: seasonal high water table at depth of 1½ feet; moderately slow permeability; 3 to 8 percent slopes.
Moderate: unstable very fine sand and silt.	Moderate: 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ feet; moderately slow permeability; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Moderate: 15 to 25 percent slopes; unstable very fine sand and silt.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Slight	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; very slow or slow permeability.	Slight	Severe: very slow or slow permeability; gravelly surface layer.
Slight	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; very slow or slow permeability.	Slight	Severe: very slow or slow permeability; gravelly surface layer.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet; very slow or slow permeability; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes; gravelly surface layer.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Dalton silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow or slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 3 to 8 percent slopes.
Danley silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: moderately slow and slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 3 to 8 percent slopes.
Danley silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: moderately slow and slow permeability.	Severe: 8 to 15 percent slopes.
Danley silty clay loam, 15 to 25 percent slopes, eroded.	Severe: 15 to 25 percent slopes.	Severe: moderately slow and slow permeability; 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Danley silty clay loam, 25 to 40 percent slopes, eroded.	Severe: 25 to 40 percent slopes.	Severe: moderately slow and slow permeability; 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.
Darien silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Darien silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 3 to 8 percent slopes.
Darien silt loam, 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: slow permeability; seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Ellery silt loam	Severe: prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot; slow to very slow permeability.	Severe: prolonged high water table at depth of 0 to ½ foot.
Erie silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Erie channery silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 3 to 8 percent slopes.
Erie channery silt loam, 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.
Slight	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow and slow permeability.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow and slow permeability; 3 to 8 percent slopes.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow and slow permeability; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.
Slight	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow permeability.
Slight	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow permeability.
Slight	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow permeability; 8 to 15 percent slopes.
Generally slight, but seasonally severe because of prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot; slow to very slow permeability.	Severe: prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot; slow to very slow permeability.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability; channery surface layer.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability.	Moderate: seasonal water table at depth of ½ to 1½ feet; 8 to 15 percent slopes; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability; 8 to 15 percent slopes; channery surface layer.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Fremont silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow or very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Fremont silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow or very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Fremont channery silt loam, 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: slow or very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.
Fremont and Hornell soils, 15 to 25 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; 15 to 25 percent slopes.	Severe: very slow and slow permeability; 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Fremont and Hornell soils, 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes; very slow and slow permeability.	Severe: 25 to 40 percent slopes.
Halsey loam	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface.
Hamlin silt loam	Severe: subject to frequent flooding.	Severe: subject to frequent flooding.	Severe: subject to frequent flooding.
Herkimer shaly silt loam, 0 to 3 percent slopes.	Moderate: seasonal high water table at depth of 2 to 2½ feet in places; rare hazard of flooding in places.	Moderate: hazard of pollution; rare hazard of flooding; seasonal high water table at depth of 2 to 2½ feet in places.	Slight
Herkimer shaly silt loam, 3 to 8 percent slopes.	Moderate: rare hazard of side stream flooding in places; seasonal high water table at depth of 2 to 2½ feet in places.	Moderate: hazard of pollution; rare hazard of flooding; seasonal high water table at depth of 2 to 2½ feet in places.	Moderate: 3 to 8 percent slopes.
Homer gravelly loam	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; hazard of pollution.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Homer gravelly loam, clayey substratum.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; hazard of pollution.	Moderate: seasonal high water table at depth of ½ to 1½ feet; susceptible to frost-heaving.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet and poor stability	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet: slow or very slow permeability.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet and poor stability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet and poor stability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or very slow permeability; 8 to 15 percent slopes; channery surface layer.
Slight	Severe: 15 to 25 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow and slow permeability; 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow and slow permeability; 15 to 25 percent slopes.
Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.
Generally slight, but seasonally severe because of prolonged high water table at surface.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface.	Severe: prolonged high high water table at surface.
Generally slight, but seasonally severe because of flooding and poor stability.	Moderate: subject to frequent flooding.	Severe: subject to frequent flooding.	Moderate; subject to frequent flooding.	Moderate: subject to frequent flooding.
Slight	Slight	Slight	Slight	Severe: 20 to 35 percent shale and gravel.
Slight	Slight	Slight	Slight	Severe: 20 to 35 percent shale and gravel.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Hornell silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.
Hornell silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet; 3 to 8 percent slopes.
Hornell silt loam, 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet; 8 to 15 percent slopes.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Severe: 8 to 15 percent slopes.
Howard gravelly loam, 0 to 3 percent slopes.	Slight	Slight: hazard of pollution	Slight
Howard gravelly loam, 3 to 8 percent slopes.	Slight	Slight: hazard of pollution	Moderate: 3 to 8 percent slopes.
Howard gravelly loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; hazard of pollution.	Severe: 8 to 15 percent slopes.
Howard gravelly loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; hazard of pollution.	Severe: 15 to 25 percent slopes.
Howard shaly silt loam, 0 to 3 percent slopes.	Slight	Slight: hazard of pollution	Slight
Howard shaly silt loam, 3 to 8 percent slopes.	Slight	Slight: hazard of pollution	Moderate: 3 to 8 percent slopes.
Howard shaly silt loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; hazard of pollution.	Severe: 8 to 15 percent slopes.
Howard-Madrid gravelly loams, 3 to 8 percent slopes.	Slight	Slight: hazard of pollution in places.	Moderate: 3 to 8 percent slopes.
Howard-Madrid gravelly loams, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; hazard of pollution in places.	Severe: 8 to 15 percent slopes.
Howard-Madrid gravelly loams, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; hazard of pollution in places.	Severe: 15 to 25 percent slopes.
Howard-Madrid shaly silt loams, 3 to 8 percent slopes.	Slight	Slight: hazard of pollution in places.	Moderate: 3 to 8 percent slopes.
Howard-Madrid shaly silt loams, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; hazard of pollution in places.	Severe: 8 to 15 percent slopes.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Moderate: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; poor trafficability; silty clay subsoil; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; poor trafficability.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability; silty clay subsoil.
Moderate: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; poor trafficability; silty clay subsoil; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; poor trafficability.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability; silty clay subsoil.
Moderate: seasonal high water table at depth of ½ to 1½ feet; rippable bedrock at depth of 1½ to 3½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; silty clay loam surface layer; 8 to 15 percent slopes.	Severe: very slow permeability; poor trafficability; silty clay subsoil; seasonal high water table at depth of ½ to 1½ feet.	Moderate: poor trafficability; 8 to 15 percent slopes.	Severe: very slow permeability; 8 to 15 percent slopes; silty clay subsoil; seasonal high water table at depth of ½ to 1½ feet.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: more than 35 percent gravel and cobblestones.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: more than 35 percent gravel and cobblestones.
Slight	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: gravelly surface layer; 8 to 15 percent slopes. Severe for trailers; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Severe: more than 35 percent gravel and cobblestones; 8 to 15 percent slopes.
Moderate: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: more than 35 percent gravel and cobblestones; 15 to 25 percent slopes.	Severe: more than 35 percent gravel and cobblestones; 15 to 25 percent slopes.
Slight	Slight	Slight	Slight	Moderate: some gravelly fragments.
Slight	Slight	Slight	Slight	Moderate: 3 to 8 percent slopes; some gravelly fragments.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Slight	Severe: 3 to 8 percent slopes; 25 to 35 percent stones.
Slight	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Severe: 8 to 15 percent slopes; 25 to 35 percent gravel.
Moderate: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; 25 to 35 percent gravel.
Slight	Slight	Slight	Slight	Severe: 20 to 35 percent shale fragments.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes; 25 to 35 percent shale.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Howard-Madrid shaly silt loams, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; hazard of pollution in places.	Severe: 15 to 25 percent slopes.
Howard and Chenango soils, 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes; hazard of pollution.	Severe: 25 to 40 percent slopes.
Ilion silt loam	Severe: prolonged high water table at suface.	Severe: prolonged high water table at surface; slow permeability.	Severe: prolonged high water table at surface.
Langford channery silt loam, 0 to 3 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: slow or very slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Langford channery silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: slow or very slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 3 to 8 percent slopes.
Langford channery silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 8 to 15 percent slopes.	Severe: slow or very slow permeability.	Severe: 8 to 15 percent slopes.
Langford channery silt loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: slow or very slow permeability, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Lansing gravelly silt loam, 2 to 8 percent slopes.	Slight	Severe: slow or very slow permeability.	Moderate: 2 to 8 percent slopes.
Lansing gravelly silt loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: slow or very slow permeability.	Severe: 8 to 15 percent slopes.
Lansing gravelly silt loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; slow or very slow permeability.	Severe: 15 to 25 percent slopes.
Lansing gravelly silt loam, 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes; slow or very slow permeability.	Severe: 25 to 40 percent slopes.
Lordstown channery silt loam, 2 to 8 percent slopes.	Severe: hard bedrock at depth of 1½ to 3½ feet.	Severe: hard bedrock at depth of 1½ to 3½ feet;	Severe: hard bedrock at depth of 1½ to 3½ feet; 2 to 8 percent slopes.
Lordstown channery silt loam, 8 to 15 percent slopes.	Severe: hard bedrock at depth of 1½ to 3½ feet.	Severe: hard bedrock at depth of 1½ to 3½ feet.	Severe: hard bedrock at depth of 1½ to 3½ feet.
Lordstown channery silt loam, 15 to 25 percent slopes.	Severe: hard bedrock at depth of 1½ to 3½ feet; 15 to 25 percent slopes.	Severe: hard bedrock at depth of 1½ to 3½ feet; 15 to 25 percent slopes.	Severe: hard bedrock at depth of 1½ to 3½ feet; 15 to 25 percent slopes.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Moderate: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; 25 to 35 percent shale fragments.
Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: more than 35 percent gravel and cobblestones; 25 to 40 percent slopes.
Generally slight, but seasonally severe because of prolonged high water table at surface.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface; slow permeability.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface; slow permeability.
Slight	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; slow or very slow permeability.	Slight	Severe: seasonal high water table at depth of 1½ to 2 feet; very slow or slow permeability; channery surface layer.
Slight	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; slow or very slow permeability; 3 to 8 percent slopes.	Slight	Severe: seasonal high water table at depth of 1½ to 2 feet; very slow or slow permeability; channery surface layer.
Slight	Moderate: 8 to 15 percent slopes; channery surface layer.	Moderate for tents: seasonal high water table at depth of 1½ to 2 feet; slow or very slow permeability; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes; channery surface layer.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; channery surface layer.
Slight	Slight	Slight	Slight	Severe: gravelly surface layer.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes; gravelly surface layer.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; gravelly surface layer.
Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes; gravelly surface layer.
Severe: hard bedrock at depth of 1½ to 3½ feet.	Moderate: hard bedrock at depth of 1½ to 3½ feet; channery surface layer.	Moderate: channery surface layer.	Moderate: channery surface layer.	Severe: channery surface layer.
Severe: hard bedrock at depth of 1½ to 3½ feet.	Moderate: hard bedrock at depth of 1½ to 3½ feet; channery surface layer: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; channery surface layer.	Moderate: 8 to 15 percent slopes; channery surface layer.	Severe: 8 to 15 percent slopes; channery surface layer.
Severe: hard bedrock at depth of 1½ to 3½ feet.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; channery surface layer.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Lordstown channery silt loam, 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.
Lyons silt loam	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface; very slow or slow permeability.	Severe: prolonged high water table at surface.
Madrid fine sandy loam, 2 to 8 percent slopes.	Slight	Moderate: moderate permeability.	Moderate: 2 to 8 percent slopes.
Madrid fine sandy loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: moderate permeability; 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes
Madrid loam, 2 to 8 percent slopes.	Slight	Moderate: moderate permeability.	Moderate: 2 to 8 percent slopes.
Madrid loam, 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: moderate permeability; 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes
Manlius shaly silt loam, 2 to 8 percent slopes.	Moderate: rippable bedrock at depth of 1½ to 3½ feet.	Severe: rippable bedrock at depth of 1½ to 3½ feet.	Moderate: rippable bedrock at depth of 1½ to 3½ feet.
Manlius shaly silt loam, 8 to 15 percent slopes.	Moderate: rippable bedrock at depth of 1½ to 3½ feet; 8 to 15 percent slopes.	Severe: rippable bedrock at at depth of 1½ to 3½ feet.	Severe: 8 to 15 percent slopes
Manlius shaly silt loam, 15 to 25 percent slopes.	Severe: 15 to 25 pecent slopes	Severe: 15 to 25 percent slopes; rippable bedrock at depth of 1½ to 3½ feet.	Severe: 15 to 25 percent slopes
Manlius shaly silt loam, 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes	Severe: 25 to 40 percent slopes; rippable bedrock at depth of 1½ to 3½ feet.	Severe: 25 to 40 percent slopes
Manlius and Lordstown soils, 40 to 90 percent slopes.	Severe: 40 to 90 percent slopes.	Severe: 40 to 90 percent slopes; bedrock at depth of 1½ to 3½ feet.	Severe: 40 to 90 percent slopes; bedrock at depth of 1½ to 3½ feet.
Mardin channery silt loam, 0 to 3 percent slopes.	Moderate: seasonal high water table at depth of 1 to 2 feet.	Severe: slow or very slow permeability.	Moderate: seasonal high water table at depth of 1 to 2 feet.
Mardin channery silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1 to 2 feet.	Severe: slow or very slow permeability.	Moderate: seasonal high water table at depth of 1 to 2 feet.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Severe: hard bedrock at depth of 1½ to 3½ feet; 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes; channery surface layer.
Generally slight, but seasonally severe because of prolonged high water table at surface.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface; very slow or slow permeability.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface; very slow or slow permeability.
Slight	Slight	Slight	Slight	Moderate: 2 to 8 percent slopes; some coarse fragments.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Slight	Slight	Slight	Slight	Moderate: 2 to 8 percent slopes; some coarse fragments.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Moderate: rippable bedrock at depth of 1½ to 3½ feet.	Moderate: rippable bedrock at depth of 1½ to 3½ feet.	Slight	Slight	Severe: shaly surface layer; rippable bedrock at depth of 1½ to 3½ feet.
Moderate: rippable bedrock at depth of 1½ to 3½ feet.	Moderate: rippable bedrock at depth of 1½ to 3½ feet; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes; rippable bedrock at depth of 1½ to 3½ feet; shaly surface layer.
Moderate: rippable bedrock at depth of 1½ to 3½ feet.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: shaly surface layer; 15 to 25 percent slopes; rippable bedrock at depth of 1½ to 3½ feet.
Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: 25 to 40 percent slopes.	Severe: shaly surface layer; 25 to 40 percent slopes; rippable bedrock at depth of 1½ to 3½ feet.
Severe: 40 to 90 percent slopes.	Severe: 40 to 90 percent slopes.	Severe: 40 to 90 percent slopes.	Severe: 40 to 90 percent slopes.	Severe: 40 to 90 percent slopes; bedrock at depth of 1½ to 3½ feet; shaly or channery surface layer.
Slight	Moderate: channery surface layer.	Moderate: seasonal high water table at depth of 1 to 2 feet; very slow or slow permeability.	Moderate: seasonal high water table at depth of 1 to 2 feet.	Severe: seasonal high water table at depth of 1 to 2 feet; slow or very slow permeability; channery surface layer.
Slight	Moderate: channery surface layer.	Moderate: seasonal high water table at depth of 1 to 2 feet; very slow or slow permeability; 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1 to 2 feet.	Severe: seasonal high water table at depth of 1 to 2 feet; very slow or slow permeability; channery surface layer.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Mardin channery silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1 to 2 feet; 8 to 15 percent slopes.	Severe: slow or very slow permeability.	Severe: 8 to 15 percent slopes.
Mardin channery silt loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; slow or very slow permeability.	Severe: 15 to 25 percent slopes.
Marilla shaly silt loam, 2 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1 to 2 feet.	Severe: slow or very slow permeability.	Moderate: seasonal high water table at depth of 1 to 2 feet; 2 to 8 percent slopes.
Marilla shaly silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1 to 2 feet; 8 to 15 percent slopes.	Severe: slow or very slow permeability.	Severe: 8 to 15 percent slopes.
Niagara silt loam	Severe: seasonal high water table at depth of 1 foot.	Severe: moderately slow or slow permeability; seasonal high water table at depth of 1 foot.	Moderate: seasonal high water table at depth of 1 foot.
Nunda silt loam, 2 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2½ feet.	Severe: moderately slow or slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2½ feet; 2 to 8 percent slopes.
Nunda silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2½ feet; 8 to 15 percent slopes.	Severe: moderately slow or slow permeability.	Severe: 8 to 15 percent slopes.
Nunda silt loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; moderately slow or slow permeability.	Severe: 15 to 25 percent slopes.
Palms muck	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface.	Severe: prolonged high water table at surface.
Palmyra gravelly loam, 0 to 3 percent slopes.	Slight	Slight: hazard of pollution	Slight
Palmyra gravelly loam, 3 to 8 percent slopes.	Slight	Slight: hazard of pollution	Moderate: 3 to 8 percent slopes.
Papakating silt loam	Severe: prolonged high water table at surface; hazard of flooding.	Severe: prolonged high water table at surface; hazard of flooding.	Severe: prolonged high water table at surface; hazard of flooding.
Papakating mucky silt loam	Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; ponding in places; frequent flooding.
Phelps gravelly loam, 0 to 3 percent slopes.	Moderate: seasonal high water table at depth of 1½ feet.	Moderate: seasonal high water table at depth of 1½ feet; hazard of pollution.	Moderate: seasonal high water table at depth of 1½ feet.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Slight	Moderate: 8 to 15 percent slopes; channery surface layer.	Moderate for tents; seasonal high water table; very slow or slow permeability; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; seasonal high water table at depth of 1 to 2 feet.	Severe: 8 to 15 percent slopes; channery surface layer.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; channery surface layer.
Slight	Slight	Moderate: very slow or slow permeability; seasonal high water table at depth of 1 to 2 feet.	Moderate: seasonal high water table at depth of 1 to 2 feet.	Severe: very slow or slow permeability; 2 to 8 percent slopes; shaly surface layer.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; seasonal high water table at depth of 1 to 2 feet.	Moderate: 8 to 15 percent slopes; seasonal high water table at depth of 1 to 2 feet.	Severe: 8 to 15 percent slopes; shaly surface layer.
Severe: unstable silt and very fine sand; seasonal high water table at depth of 1 foot.	Moderate: seasonal high water table at depth of 1 foot.	Severe: seasonal high water table at depth of 1 foot; moderately slow to slow permeability.	Moderate: seasonal high water table at depth of 1 foot.	Severe: seasonal high water table at depth of 1 foot; moderately slow or slow permeability.
Slight	Slight	Moderate: seasonal high water table at depth of 1½ to 2½ feet; moderately slow or slow permeability.	Slight	Moderate: seasonal high water table at depth of 1½ to 2½ feet; moderately slow or slow permeability; 2 to 8 percent slopes.
Slight	Moderate: 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes; moderately slow or slow permeability; seasonal high water table at depth of 1½ to 2½ feet.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Slight	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.
Severe: prolonged high water table at surface; instability of muck.	Severe: prolonged high water table at surface; instability of muck.	Severe: prolonged high water table at surface; instability of muck.	Severe: prolonged high water table at surface; instability of muck.	Severe: prolonged high water table at surface; instability of muck.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.
Slight	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.
Moderate: prolonged high water table at surface; hazard of flooding.	Severe: prolonged high water table at surface; hazard of flooding.	Severe: prolonged high water table at surface; hazard of flooding.	Severe: prolonged high water table at surface; hazard of flooding.	Severe: prolonged high water table at surface; hazard of flooding.
Severe: prolonged high water table at surface; instability of soil material; frequent flooding.	Severe: prolonged high water table at surface; ponding in places; frequent flooding.	Severe: prolonged high water table at surface; ponding in places; frequent flooding.	Severe: prolonged high water table at surface; ponding in places; frequent flooding.	Severe: prolonged high water table at surface; ponding in places; frequent flooding.
Generally slight, but seasonally severe because of high water table at depth of 1½ feet.	Moderate: gravelly surface layer.	Severe: seasonal high water table at depth of 1½ feet; gravelly surface layer.	Moderate: seasonal high water table at depth of 1½ feet; gravelly surface layer.	Severe: gravelly surface layer.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Phelps gravelly loam, 3 to 8 percent slopes	Moderate: seasonal high water table at depth of 1½ feet.	Moderate: seasonal high water table at depth of 1½ feet; hazard of pollution.	Moderate: seasonal high water table at depth of 1½ feet; 3 to 8 percent slopes.
Red Hook gravelly loam	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; hazard of pollution.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Rock outcrop	Severe: rock outcrop; steep slopes.	Severe: rock outcrop; steep slopes.	Severe: rock outcrop; steep slopes.
Scio silt loam, 0 to 3 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Moderate: moderate permeability; seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Scio silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Moderate: moderate permeability; seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 3 to 8 percent slopes.
Sun silt loam	Severe: prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot; moderately slow or slow permeability.	Severe: prolonged high water table at depth of 0 to ½ foot.
Teel silt loam	Severe: annual flooding; seasonal high water table at depth of 1½ to 2 feet.	Severe: annual flooding; seasonal high water table at depth of 1½ to 2 feet.	Severe: annual flooding; seasonal high water table at depth of 1½ to 2 feet.
Tioga silt loam	Severe: occasional flooding	Severe: occasional flooding	Severe: occasional flooding
Tuller channery silt loam, 0 to 3 percent slopes.	Severe: water table at depth of 0 to 1 foot; hard bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot; hard bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot; hard bedrock at depth of 1 to 1½ feet.
Tuller channery silt loam, 3 to 8 percent slopes.	Severe: water table at depth of 0 to 1 foot; bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot; bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot; bedrock at depth of 1 to 1½ feet.
Varysburg gravelly loam, 2 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2½ feet.	Severe: slow or very slow permeability.	Moderate: 2 to 8 percent slopes; seasonal high water table at depth of 1½ to 2½ feet.
Varysburg gravelly loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2½ feet; 8 to 15 percent slopes.	Severe: slow or very slow permeability.	Severe: 8 to 15 percent slopes; cut slope slippage.
Varysburg gravelly loam, 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes	Severe: 15 to 25 percent slopes; slow or very slow permeability.	Severe: 15 to 25 percent slopes; cut slope slippage.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Generally slight, but seasonally severe because of high water table at depth of 1½ feet.	Moderate: gravelly surface layer.	Moderate: seasonal high water table at depth of 1½ feet.	Moderate: seasonal high water table at depth of 1½ feet; gravelly surface layer.	Severe: gravelly surface layer.
Generally slight, but seasonally severe because of high water table at depth of ½ to to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; gravelly surface layer.
Severe: rock outcrop; steep slopes.	Severe: rock outcrop; steep slopes.	Severe: rock outcrop; steep slopes.	Severe: rock outcrop; steep slopes.	Severe: rock outcrop; steep slopes.
Severe: unstable very fine sand and silt in cuts.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Severe: unstable very fine sand and silt in cuts.	Slight	Moderate: seasonal high water table at depth of 1½ to 1 feet.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; 3 to 8 percent slopes.
Generally slight, but seasonally severe because of prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot; moderately slow or slow permeability.	Severe: prolonged high water table at depth of 0 to ½ foot.	Severe: prolonged high water table at depth of 0 to ½ foot; moderately slow or slow permeability.
Generally moderate, but seasonally severe because of flooding and high water table at depth of 1½ to 2 feet; unstable silt loam.	Moderate: occasional flooding during period of use.	Severe: occasional flooding during period of use.	Moderate: occasional flooding during period of use.	Moderate: occasional flooding during period of use.
Generally slight, but seasonally severe because of flooding and poor stability.	Moderate: occasional flooding.	Severe: occasional flooding.	Moderate: occasional flooding.	Moderate: occasional flooding.
Severe: water table at depth of 0 to 1 foot; hard bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot; hard bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot.	Severe: water table at depth of 0 to 1 foot.	Severe: water table at depth of 0 to 1 foot; hard bedrock at depth of 1 to 1½ feet; channery surface layer.
Severe: water table at depth of 0 to 1 foot; bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot; bedrock at depth of 1 to 1½ feet.	Severe: water table at depth of 0 to 1 foot.	Severe: water table at depth of 0 to 1 foot.	Severe: water table at depth of 0 to 1 foot; bedrock at depth of 1 to 1½ feet; channery surface layer.
Moderate: cut instability in substratum.	Moderate: gravelly surface layer.	Moderate: seasonal high water table at depth of 1½ to 2½ feet; gravelly surface layer.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.
Moderate: cut instability in substratum.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Moderate: 8 to 15 percent slopes; seasonal high water table at depth of 1½ to 2½ feet; gravelly surface layer.	Moderate: 8 to 15 percent slopes; gravelly surface layer.	Severe: 8 to 15 percent slopes; gravelly surface layer.
Severe: cut instability in substratum.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes.	Severe: 15 to 25 percent slopes; gravelly surface layer.

TABLE 7.—*Limitations of the soils*

Soil	Homesites	Septic tank filter fields	Streets and parking lots
Volusia channery silt loam, 0 to 3 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Volusia channery silt loam, 3 to 8 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 3 to 8 percent slopes.
Volusia channery silt loam, 8 to 15 percent slopes.	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: very slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Severe: 8 to 15 percent slopes.
Wallington silt loam	Severe: seasonal high water table at depth of ½ to 1½ feet.	Severe: moderately slow or slow permeability; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.
Wallkill silt loam	Severe: prolonged wetness; frequent flooding.	Severe: prolonged wetness; frequent flooding.	Severe: prolonged wetness; hazard of flooding; unstable material.
Wayland silt loam	Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; frequent flooding.
Williamson silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: slow or moderately slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 3 to 8 percent slopes.
Williamson silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 8 to 15 percent slopes.	Severe: slow or moderately slow permeability.	Severe: 8 to 15 percent slopes; cut instability.
Williamson channery silt loam, 3 to 8 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: slow or moderately slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 3 to 8 percent slopes.
Williamson channery silt loam, 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet; 8 to 15 percent slopes.	Severe: slow or moderately slow permeability.	Severe: 8 to 15 percent slopes; cut instability.

for town and country planning—Continued

Pipeline installations	Lawns, landscaping, and golf fairways	Campsites	Picnic areas	Athletic fields
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet and poor stability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability; channery surface layer.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet and poor stability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability; channery surface layer.
Generally slight, but seasonally severe because of high water table at depth of ½ to 1½ feet and poor stability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet; 8 to 15 percent slopes; channery surface layer.	Severe: seasonal high water table at depth of ½ to 1½ feet; very slow permeability; 8 to 15 percent slopes; channery surface layer.
Severe: unstable silt and very fine sand; seasonal high water table at depth of ½ to 1½ feet.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or moderately slow permeability.	Moderate: seasonal high water table at depth of ½ to 1½ feet.	Severe: seasonal high water table at depth of ½ to 1½ feet; slow or moderately slow permeability.
Severe: prolonged wetness; frequent flooding.	Severe: prolonged wetness; frequent flooding.	Severe: prolonged wetness; frequent flooding.	Severe: prolonged wetness; frequent flooding.	Severe: prolonged wetness; frequent flooding.
Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; frequent flooding.	Severe: prolonged high water table at surface; frequent flooding.
Moderate: unstable very fine sand and silt.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow or slow permeability.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow or slow permeability; 3 to 8 percent slopes.
Moderate: unstable very fine sand and silt.	Moderate: 8 to 15 percent slopes.	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow or slow permeability; 8 to 15 percent slopes.	Moderate: 8 to 15 percent slopes.	Severe: 8 to 15 percent slopes.
Moderate: unstable very fine sand and silt.	Moderate: channery surface layer.	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow or slow permeability; channery surface layer.	Moderate: channery surface layer.	Severe: channery surface layer.
Moderate: unstable very fine sand and silt.	Moderate: 8 to 15 percent slopes; channery surface layer.	Moderate for tents: seasonal high water table at depth of 1½ to 2 feet; moderately slow or slow permeability; 8 to 15 percent slopes; channery surface layer.	Moderate: 8 to 15 percent slopes; channery surface layer.	Severe: 8 to 15 percent slopes; channery surface layer.

Descriptions of the Soils

This section describes the soil series and mapping units in Wyoming County. Each soil series is first described in detail and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soil.

The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for a moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Alluvial land and Rock outcrop, for example, do not belong to a soil series but, nevertheless, are listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit and woodland suitability group in which the mapping unit has been placed. The page for the description of each capability unit and woodland suitability group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 8. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*).

Alden Series

The Alden series is made up of deep, very poorly drained, medium-textured soils. These soils formed in silty local alluvium underlain by loamy till. They generally are neutral in reaction and have a surface layer that is very rich in organic matter. These nearly level soils are in depressions on the plateau on uplands. They are uniformly distributed across the entire county.

In a representative profile the surface layer is black mucky silt loam 7 inches thick. The upper part of the subsoil is friable, gray silt loam that contains a few mottles. The lower part is friable, dark-gray silt loam that contains a few mottles and has few or no coarse fragments. The substratum, to a depth of 50 inches or more, is grayish-brown gravelly loam. The substratum is more mottled than the horizons above. It is firm and calcareous.

Alden soils have a prolonged seasonal high water table. During periods of extreme wetness these soils are ponded, and the water table remains near the surface most of the time. Only in exceptionally dry periods does the water table drop to any great depth. The rooting depth generally is the upper few inches of the soil. If the soils are adequately drained, roots extend to a depth of 30 inches or more. Available water capacity is moderate to high. Permeability is moderately slow in the subsoil and slow in the substratum. The soils have medium reserves of potash and phosphorus and high reserves of lime and nitrogen.

Representative profile of Alden mucky silt loam in a pasture 2 miles east of the village of Warsaw, in a field on the west side of Adams Road, 700 feet north of U.S. Highway 20A:

Ap—0 to 7 inches, black (10YR 2/1) mucky silt loam; few, fine, reddish-brown (5YR 4/4) mottles; moderate, coarse, granular structure; friable; many fine roots; 5 percent gravel; slightly acid; clear, wavy boundary.

B21g—7 to 15 inches, gray (N 5/0) silt loam; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, fine, subangular blocky structure; friable; few fine roots; few fine pores; 5 percent gravel; slightly acid; clear, wavy boundary.

B22g—15 to 30 inches, dark-gray (10YR 4/1) silt loam; few, medium and fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, coarse, prismatic structure that parts to weak, coarse, subangular blocky; friable; few fine pores with clay linings; neutral; gradual, wavy boundary.

IICg—30 to 50 inches, grayish-brown (10YR 5/2) gravelly loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, platy structure; firm; few fine pores; 20 percent gravel; calcareous in lower part; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness. Carbonates are at a depth of 40 to 60 inches. Bedrock is typically at a depth of more than 6 feet but in places is as shallow as 40 inches.

In undisturbed areas the dark gray (10YR 4/1) to very dark gray (10YR 3/1) surface layer is overlain by a 2- to 6-inch O2 horizon. The Ap horizon has a hue of 10YR or 7.5YR, a value of 2 or 3, and a chroma of 1. The Ap horizon is very fine sandy loam to silt loam, and it is 10 to about 20 percent organic matter. This horizon is slightly acid to neutral.

The Bg horizon has a hue of 10YR or 7.5YR, a value of 4 to 6, and a chroma of 0 to 2. It has subhorizons of very fine sandy loam, silt loam, or silty clay loam and has mottling from few to common, distinct to prominent, in chroma higher than 2.

The B21 horizon is massive or has weak or moderately blocky structure that is within weak to moderate, coarse to very coarse prisms in places.

The B22 horizon has weak blocky or moderate platy structure in weak to moderate, medium to very coarse prisms. It is friable to firm and is slightly acid to neutral.

The IIC horizon is coarser in texture and contains more coarse fragments than the horizons above it. It is massive or has platy structure without prisms. Reaction is neutral to moderately alkaline. This horizon is calcareous in places.

Alden soils commonly are near the poorly drained Ellery soils and the very poorly drained to poorly drained Sun soils. They lack the fragipan of Ellery soils and have a finer textured B horizon than Sun soils. Alden soils are similar to Halsey and Papakating soils. They lack the gravelly or sandy C horizon of Halsey soils within a depth of 40 inches, and they are less silty than Papakating soils.

Alden mucky silt loam (Ad).—This is the only Alden soil mapped in the county. This nearly level soil is in depressions adjacent to better drained soils from which it receives runoff. Individual areas are small, depressed, and circular or are larger and oblong and frequently have water ponded on the surface. Individual areas vary in size.

TABLE 8.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Alden mucky silt loam	3,950	1.0
Allard silt loam, 0 to 3 percent slopes	1,170	.3
Allard silt loam, 3 to 8 percent slopes	890	.2
Allard silt loam, 8 to 15 percent slopes	270	.1
Alluvial land	4,050	1.1
Angola shaly silt loam, 0 to 3 percent slopes	200	.1
Angola and Aurora shaly silt loams, 3 to 8 percent slopes	390	.1
Appleton gravelly silt loam, 0 to 3 percent slopes	4,240	1.1
Appleton gravelly silt loam, 3 to 8 percent slopes	890	.2
Arkport very fine sandy loam, 2 to 8 percent slopes	290	.1
Arkport very fine sandy loam, 8 to 15 percent slopes	430	.1
Arkport very fine sandy loam, 15 to 25 percent slopes	870	.2
Arkport very fine sandy loam, 25 to 40 percent slopes	1,160	.3
Arnot channery silt loam, 2 to 8 percent slopes	1,010	.3
Arnot channery silt loam, 8 to 15 percent slopes	410	.1
Aurora shaly silt loam, 8 to 15 percent slopes	450	.1
Bath channery silt loam, 0 to 3 percent slopes	770	.2
Bath channery silt loam, 3 to 8 percent slopes	9,220	2.4
Bath channery silt loam, 8 to 15 percent slopes	3,810	1.0
Bath channery silt loam, 15 to 25 percent slopes	2,070	.5
Bath channery silt loam, 25 to 40 percent slopes	2,140	.6
Bath-Valois gravelly loams, 0 to 3 percent slopes	1,250	.3
Bath-Valois gravelly loams, 3 to 8 percent slopes	12,270	3.2
Bath-Valois gravelly loams, 8 to 15 percent slopes	11,280	3.0
Bath-Valois gravelly loams, 15 to 25 percent slopes	2,700	.7
Burdett silt loam, 0 to 3 percent slopes	930	.2
Burdett silt loam, 3 to 8 percent slopes	840	.2
Canadice silty clay loam	750	.2
Canaseraga silt loam, 0 to 3 percent slopes	610	.2
Canaseraga silt loam, 3 to 8 percent slopes	2,800	.8
Canaseraga silt loam, 8 to 15 percent slopes	600	.2
Caneadea silt loam, 0 to 3 percent slopes	450	.1
Caneadea silt loam, 3 to 8 percent slopes	1,150	.3
Caneadea silt loam, 8 to 15 percent slopes	1,190	.3
Caneadea silty clay loam, 15 to 25 percent slopes, eroded	2,050	.6
Caneadea silty clay loam, 25 to 50 percent slopes, eroded	1,880	.5
Castile gravelly loam, 0 to 3 percent slopes	960	.3
Castile gravelly loam, 3 to 8 percent slopes	2,910	.8
Castile channery silt loam, fans, 0 to 3 percent slopes	620	.2
Chenango gravelly loam, 0 to 3 percent slopes	5,060	1.3
Chenango gravelly loam, 3 to 8 percent slopes	3,760	1.0
Chenango gravelly loam, 8 to 15 percent slopes	2,470	.6
Chenango gravelly loam, 15 to 25 percent slopes	870	.2
Chenango channery silt loam, fans, 3 to 8 percent slopes	870	.2
Churchville silt loam, 2 to 8 percent slopes	1,460	.4
Churchville silt loam, 8 to 15 percent slopes	790	.2
Collamer silt loam, 3 to 8 percent slopes	840	.2
Collamer silt loam, 8 to 15 percent slopes	810	.2
Collamer silt loam, 15 to 25 percent slopes	490	.1
Conesus gravelly silt loam, 0 to 3 percent slopes	1,770	.5
Conesus gravelly silt loam, 3 to 8 percent slopes	11,340	3.0
Conesus gravelly silt loam, 8 to 15 percent slopes	1,520	.4
Dalton silt loam, 0 to 3 percent slopes	3,100	.8
Dalton silt loam, 3 to 8 percent slopes	1,520	.4
Danley silt loam, 3 to 8 percent slopes	820	.2
Danley silt loam, 8 to 15 percent slopes	740	.2
Danley silty clay loam, 15 to 25 percent slopes, eroded	1,170	.3
Danley silty clay loam, 25 to 40 percent slopes, eroded	470	.1
Darien silt loam, 0 to 3 percent slopes	1,110	.3
Darien silt loam, 3 to 8 percent slopes	3,290	.9
Darien silt loam, 8 to 15 percent slopes	820	.2
Ellery silt loam	10,390	2.7
Erie silt loam, 0 to 3 percent slopes	22,640	6.0
Erie channery silt loam, 3 to 8 percent slopes	11,650	3.1
Erie channery silt loam, 8 to 15 percent slopes	2,000	.5
Fremont silt loam, 0 to 3 percent slopes	4,440	1.2
Fremont silt loam, 3 to 8 percent slopes	7,750	2.1
Fremont channery silt loam, 8 to 15 percent slopes	1,950	.5
Fremont and Hornell soils, 15 to 25 percent slopes	990	.3
Fremont and Hornell soils, 25 to 40 percent slopes	300	.1
Halsey loam	4,880	1.3
Hamlin silt loam	880	.2
Herkimer shaly silt loam, 0 to 3 percent slopes	1,510	.4
Herkimer shaly silt loam, 3 to 8 percent slopes	1,450	.4
Homer gravelly loam	1,410	.4
Homer gravelly loam, clayey substratum	430	.1
Hornell silt loam, 0 to 3 percent slopes	470	.1
Hornell silt loam, 3 to 8 percent slopes	2,390	.6
Hornell silt loam, 8 to 15 percent slopes	760	.2
Howard gravelly loam, 0 to 3 percent slopes	1,510	.4
Howard gravelly loam, 3 to 8 percent slopes	1,640	.4
Howard gravelly loam, 8 to 15 percent slopes	2,180	.6
Howard gravelly loam, 15 to 25 percent slopes	1,400	.4
Howard shaly silt loam, 0 to 3 percent slopes	470	.1
Howard shaly silt loam, 3 to 8 percent slopes	590	.2
Howard shaly silt loam, 8 to 15 percent slopes	560	.1
Howard-Madrid gravelly loams, 3 to 8 percent slopes	4,280	1.1
Howard-Madrid gravelly loams, 8 to 15 percent slopes	7,090	1.9
Howard-Madrid gravelly loams, 15 to 25 percent slopes	1,020	.3
Howard-Madrid shaly silt loams, 3 to 8 percent slopes	570	.1
Howard-Madrid shaly silt loams, 8 to 15 percent slopes	660	.2
Howard-Madrid shaly silt loams, 15 to 25 percent slopes	390	.1
Howard and Chenango soils, 25 to 40 percent slopes	2,530	.7
Ilion silt loam	3,010	.8
Langford channery silt loam, 0 to 3 percent slopes	1,620	.4
Langford channery silt loam, 3 to 8 percent slopes	20,680	5.4
Langford channery silt loam, 8 to 15 percent slopes	8,430	2.2
Langford channery silt loam, 15 to 25 percent slopes	1,650	.4
Lansing gravelly silt loam, 2 to 8 percent slopes	3,480	.9
Lansing gravelly silt loam, 8 to 15 percent slopes	4,170	1.1
Lansing gravelly silt loam, 15 to 25 percent slopes	2,320	.6
Lansing gravelly silt loam, 25 to 40 percent slopes	1,730	.5
Lordstown channery silt loam, 2 to 8 percent slopes	1,740	.5
Lordstown channery silt loam, 8 to 15 percent slopes	890	.2
Lordstown channery silt loam, 15 to 25 percent slopes	810	.2
Lordstown channery silt loam, 25 to 40 percent slopes	790	.2
Lyons silt loam	640	.2
Madrid fine sandy loam, 2 to 8 percent slopes	540	.1

See footnote at end of table.

TABLE 8.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Madrid fine sandy loam, 8 to 15 percent slopes	230	.1	Red Hook gravelly loam	2,360	.6
Madrid loam, 2 to 8 percent slopes	830	.2	Rock outcrop	2,260	.6
Madrid loam, 8 to 15 percent slopes	440	.1	Scio silt loam, 0 to 3 percent slopes	1,860	.5
Manlius shaly silt loam, 2 to 8 percent slopes	720	.2	Scio silt loam, 3 to 8 percent slopes	730	.2
Manlius shaly silt loam, 8 to 15 percent slopes	630	.2	Sun silt loam	2,540	.6
Manlius shaly silt loam, 15 to 25 percent slopes	910	.2	Teel silt loam	2,070	.5
Manlius shaly silt loam, 25 to 40 percent slopes	1,490	.4	Tioga silt loam	800	.2
Manlius and Lordstown soils, 40 to 90 percent slopes	1,660	.4	Tuller channery silt loam, 0 to 3 percent slopes	1,950	.5
Mardin channery silt loam, 0 to 3 percent slopes	3,840	1.0	Tuller channery silt loam, 3 to 8 percent slopes	670	.2
Mardin channery silt loam, 3 to 8 percent slopes	16,580	4.3	Varysburg gravelly loam, 2 to 8 percent slopes	1,630	.4
Mardin channery silt loam, 8 to 15 percent slopes	5,850	1.5	Varysburg gravelly loam, 8 to 15 percent slopes	730	.2
Mardin channery silt loam, 15 to 25 percent slopes	1,060	.3	Varysburg gravelly loam, 15 to 25 percent slopes	790	.2
Marilla shaly silt loam, 2 to 8 percent slopes	2,440	.6	Volusia channery silt loam, 0 to 3 percent slopes	9,030	2.4
Marilla shaly silt loam, 8 to 15 percent slopes	740	.2	Volusia channery silt loam, 3 to 8 percent slopes	10,620	2.7
Niagara silt loam	450	.1	Volusia channery silt loam, 8 to 15 percent slopes	1,040	.3
Nunda silt loam, 2 to 8 percent slopes	1,810	.4	Wallington silt loam	400	.1
Nunda silt loam, 8 to 15 percent slopes	1,280	.3	Wallkill silt loam	1,370	.4
Nunda silt loam, 15 to 25 percent slopes	890	.2	Wayland silt loam	2,630	.7
Palms muck	2,310	.6	Williamson silt loam, 3 to 8 percent slopes	430	.1
Palmyra gravelly loam, 0 to 3 percent slopes	790	.2	Williamson silt loam, 8 to 15 percent slopes	670	.2
Palmyra gravelly loam, 3 to 8 percent slopes	350	.1	Williamson channery silt loam, 3 to 8 percent slopes	1,640	.4
Papakating silt loam	2,380	.6	Williamson channery silt loam, 8 to 15 percent slopes	540	.1
Papakating mucky silt loam	1,960	.5	Dumps	200	(1)
Phelps gravelly loam, 0 to 3 percent slopes	1,160	.3	Gravel pits	430	.1
Phelps gravelly loam, 3 to 8 percent slopes	410	.1	Quarries	70	(1)
			Water	1,360	.3
			Total	382,720	100.0

[1] Less than 0.05 percent.

Circular areas range from 5 to 10 acres, and long, oblong areas, from 20 to 50 acres.

Included with this soil in mapping were isolated spots of better drained Ellery and Sun soils on slight rises in the till plain. Also included were areas of Alden soils mapped along drainageways and streams near Halsey soils that are underlain by gravel in places.

This Alden soil is not suited to farming unless artificially drained. Undrained areas support water-tolerant species of shrubs and trees. Some areas can be drained and used for row crops, hay, or pasture. Drainage outlets generally are difficult to locate. Capability unit IVw-5; woodland suitability group 4w1.

Allard Series

The Allard series is made up of deep, well-drained, acid soils. They formed in a thin mantle of silt or very fine sand that is underlain by stratified glacial outwash. These soils are nearly level to moderately sloping and are on stream terraces in the southeastern part of the county.

In a representative profile the surface layer is dark grayish-brown silt loam 8 inches thick. The upper part of the subsoil is yellowish-brown, very friable silt loam about 6 inches thick. Below a depth of 14 inches the subsoil is brown or dark yellowish brown and is friable or firm. The subsoil is strongly acid and contains very few or no coarse fragments. Below a depth of 24 inches the substratum is very gravelly loamy sand that generally is loose or slightly firm in place and is medium acid in reaction.

Allard soils are well suited to row crops where they are not too sloping. Natural fertility is medium to low, but crops respond well to liberal applications of lime and fertilizer. These soils dry out quickly after rain. The rooting zone generally is about 24 inches thick, but deep-rooted plants easily exceed this depth. Available water capacity is moderate to high. Permeability is moderate in the subsoil and very rapid in the substratum. These soils are very desirable for crop production that requires the use of heavy, soil-penetrating harvesting equipment.

Representative profile of Allard silt loam, 0 to 3 percent slopes, in a cultivated field 2 miles south of the village of Pike, 300 feet south of the junction of State Route 19 and Wolfe Road, 10 feet from edge of gravel pit on west side of State Route 19:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium and fine, granular structure; very friable; many fine roots; many pores; medium acid; abrupt, smooth boundary.

B21—8 to 14 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium and fine, granular structure; very friable; many fine roots; many pores; strongly acid; clear, wavy boundary.

B22—14 to 20 inches, brown (10YR 5/3) silt loam; weak, medium, subangular blockly structure; friable; common fine roots; many fine pores; strongly acid; clear, wavy boundary.

B23—20 to 24 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; slightly firm; few roots; few pores; 2 percent pebbles; strongly acid; clear, wavy boundary.

IIC—24 to 40 inches, brown (10YR 4/3) and grayish-brown (10YR 5/2) very gravelly loamy sand; single grain; slightly firm in place; few medium roots; 50 percent gravel; medium acid.

The solum ranges from 20 to 36 inches in thickness and corresponds with the depth to sandy or sandy skeletal material. Bedrock is at a depth of more than 40 inches, and it is typically at a depth of more than 10 feet. The solum is typically free of coarse fragments, but a few pebbles or thin layers of gravelly material are within the solum in places. Reaction is strongly acid or very strongly acid below the Ap horizon and increases with depth to medium acid or slightly acid below a depth of 30 inches.

The Ap horizon has a hue of 2.5Y to 7.5YR, a value of 3 or 4, and a chroma of 2 or 3.

The B horizon has a hue of 2.5Y to 7.5YR, a value of 5, and a chroma of 3 to 6. It is very fine sandy loam or silt loam. Clay films are few in number or are absent and are in pore linings. Lamellae or irregularly shaped areas that are slightly darker, measurably higher in clay, and more firm than the matrix are in some profiles but are less than 6 inches thick. Mottles of chroma higher than that in the matrix are below a depth of 20 inches in some profiles.

The C horizon is loose sand or gravelly and sandy material that is dominantly coarser than fine sand.

Allard soils are closely associated with soils of the Arkport, Chenango, Howard, and Scio series. Allard soils lack the thick accumlation of bands that is in the solum of Arkport soils, and they formed in 20 to 36 inches of silty regolith over gravel in contrast to Arkport soils, which formed in deep sandy material. Allard soils have an essentially gravel-free solum in contrast to the Chenango and Howard soils. They formed in thinner silt deposits than the moderately well drained Scio soils.

Allard silt loam, 0 to 3 percent slopes (AlA).—This nearly level soil has the profile described as representative for the series. It is on silt-mantled, gravelly stream terraces in the southeastern part of the county. These terraces are mainly along East Koy and Wiscoy Creeks and the Genesee River. Most individual areas are roughly rectangular or irregular in shape and are 15 to 30 acres or more in size.

Included with this soil in mapping were areas of soils that have a thicker silt mantle over gravel. Also included were small areas of soils that have a mantle less than 1½ feet thick.

This Allard soil is suited to most crops. Potatoes grow very well in it. Corn, potatoes, and beans are the main crops. Lime and fertilizer needs are high. Use of mechanical harvesters is not restricted by stones. Capability unit I–1; woodland suitability group 2o1.

Allard silt loam, 3 to 8 percent slopes (AlB).—This gently sloping soil is on silt-mantled, gravelly stream terraces in the southeastern part of the county. These terraces are mainly along East Koy and Wiscoy Creeks and the Genesee River. Most areas are long and narrow and are along the shoulder of the stream terrace. Some runoff from adjacent nearly level Allard soil is received by this soil, but the water is readily removed.

Included with this soil in mapping were areas of a soil that has less than 1½ feet of silt over gravel. Also included were spots of Chenango and Howard soils.

This Allard soil is used for potatoes, beans, and crops used for dairying. Lime and fertilizer needs generally are high. The hazard of erosion is moderate if this soil is cultivated and not protected. Capablity unit IIe–3; woodland suitability group 2o1.

Allard silt loam, 8 to 15 percent slopes (AlC).—This moderately sloping soil has irregular convex slopes. It receives little or no runoff from adjacent soils. Individual areas are small and generally are less than 25 acres in size.

Included with this soil in mapping were spots of coarser textured Arkport soils and areas of soils where the silt deposit is thicker than is typical for this Allard soil.

This Allard soil is suited to crops, pasture, or woodland. The hazard of erosion is severe if the soil is cultivated and not protected. Complex slopes are common, so the use of contour measures is not always feasible. In these areas sod-forming crops should be favored in the cropping system. Capability unit IIIe–3; woodland suitability group 2r2.

Alluvial Land

Alluvial land (Am) is made up of intermingled small areas of nearly level soils on deposits of alluvium. The areas are in narrow strips along the smaller streams of the survey area, or they occur as a gravelly soil mass in areas of riverwash, particularly along the Genessee River.

Alluvial land is subject to stream cutting and erosion that shift the soil material from one place to another downstream. This process is accelerated during flooding. Soil drainage, texture, and the content of fragments vary widely within a short distance.

Most areas of this land are in brush, but a few areas are cleared and used for pasture. Areas of gravelly riverwash commonly have no vegetation. Areas that are suitable for pasture are difficult to manage, because they commonly are long narrow channels, and bank escarpments cut them off from adjoining fields.

The hazard of annual flooding adversely affects the use of Alluvial land. Capability unit and woodland suitability group not assigned.

Angola Series

The Angola series is made up of moderately deep, somewhat poorly drained, medium-textured soils that have a medium-textured to moderately fine textured subsoil. These soils formed in low-lime glacial till that is dominantly gray shale. They are nearly level to gently sloping and are on glaciated uplands in the northern part of the county.

In a representative profile the surface layer is very dark grayish-brown shaly silt loam 8 inches thick. The subsurface layer is medium acid, friable, light brownish-gray shaly silt loam about 5 inches thick. It contains many distinct mottles. The upper part of the subsoil, at a depth of 13 to 21 inches, is dark grayish-brown, firm, shaly light silty clay loam that contains many mottles and is slightly acid. The lower part of the subsoil is firm, mottled dark grayish-brown shaly light silty clay loam about 7 inches thick. Reaction in the lower part of the subsoil is neutral, and the content of shale fragments is greater than that in the upper part. Olive-brown and dark grayish-brown hard shale bedrock is at a depth of 28 inches and is weakly calcareous

Angola soils have a temporary high water table within a depth of 6 inches early in spring and during excessively wet periods. The rooting depth generally is 20 inches. Available water capacity is moderate. Permeability is slow in the subsoil. Natural fertility is medium.

Representative profile of Angola shaly silt loam, 0 to 3 percent slopes, in a cultivated field in the town of Covington, on Peoria Road, 1 mile north of the hamlet of Peoria:

Ap—0 to 8 inches, very dark grayish-brown (2.5Y 3/2) shaly silt loam, light brownish gray (2.5Y 6/2) crushed and dry; moderate, medium, granular structure; very

friable; many fine roots and pores; 15 percent shale fragments; slightly acid; abrupt, smooth boundary.

A2—8 to 13 inches, light brownish-gray (2.5Y 6/2) shaly silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; common fine roots; common pores; 15 percent shale fragments; medium acid; clear, wavy boundary; distinct interfingering of A2 material into the B21tg horizon.

B21tg—13 to 21 inches, dark grayish-brown (2.5Y 4/2) shaly light silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles surrounded by olive-brown (2.5Y 4/4) mottles; few, faint, gray (10YR 5/1) mottles; moderate, fine and medium, subangular blocky structure; firm; common fine roots; few pores with clay linings; patchy clay coats on ped faces; 15 percent shale fragments; slightly acid; clear, wavy boundary.

B22tg—21 to 28 inches, dark grayish-brown (2.5Y 4/2) shaly light silty clay loam; many, combined, yellowish-brown (10YR 5/6) and olive (5Y 4/4), medium, distinct mottles; moderate, medium, subangular blocky structure; firm; few fine roots; few, fine, medium pores with clay linings; patchy, gray clay coats on ped faces; 25 percent shale fragments; neutral; abrupt, smooth boundary.

R—28 to 40 inches, olive-brown (2.5Y 4/4) and dark grayish-brown (10YR 4/2) fissile shale bedrock; hard; very few fractures; weakly calcareous; moderately alkaline.

The solum ranges from 20 to 30 inches in thickness. Bedrock, at a depth of 40 inches, is brittle, neutral or calcareous, dark-colored shale. The content of coarse fragments ranges from 5 to 25 percent, by volume, in the upper part of the solum to 20 to 35 percent in the lower part.

The Ap horizon has a hue of 10YR or 2.5Y, a value of 3 or 4 when moist and 6 or more when dry, and a chroma of 2. This horizon is silt loam and is slightly acid to neutral.

A thin A2 horizon is in most profiles. It is similar to the Ap horizon, except that it has a value of 5 or 6 and a chroma of 2 or 3.

The B horizon has a hue of 10YR to 5Y, a value of 3 or 4, and a chroma of 2 to 4. This horizon is silt loam to silty clay loam, and the content of clay is 18 to 35 percent. It has moderate, fine to medium, subangular blocky structure and is slightly acid to mildly alkaline.

A thin C horizon is in some profiles. It is somewhat lower in content of clay and higher in content of shale fragments than the B horizon.

Angola soils are closely associated with moderately well drained Aurora soils that formed in similar material and are also moderately deep over shale. They are also similar to somewhat poorly drained Appleton, Burdett, and Darien soils, all of which are deeper than the Angola soils.

Angola shaly silt loam, 0 to 3 percent slopes (AnA).—This nearly level soil has the profile described as representative for the series. It commonly receives runoff from adjacent areas.

Included with this soil in mapping were Burdett and Darien soils in areas where the bedrock is at a depth of more than 40 inches.

This Angola soil is not suited to row crops unless it is artificially drained. Crops, such as birdsfoot trefoil, grow well. Tile drains are difficult to install in places, but the shale rock generally can be excavated with tiling machines. Capability unit IIIw-1; woodland suitability group 3w1.

Angola and Aurora shaly silt loams, 3 to 8 percent slopes (AoB).—This mapping unit consists of gently sloping Angola and Aurora soils. Either or both soils are in delineated areas. These soils have profiles similar to those described as representative for their respective series. About 55 percent of the areas are occupied by Angola soils, which are mainly on the lower concave foot slopes below and threading up into the convex areas occupied by the Aurora soils. They also occupy the wetter saddles of undulating areas. Aurora soils occupy about 45 percent of the areas.

Included with this unit in mapping were similar Danley and Darien soils in areas where the bedrock is at a depth of more than 40 inches.

The areas of this mapping unit can be used for row crops, but the wetter areas need artificial drainage. Tile lines are difficult to install in places. Crops used for dairying are grown. Some areas are idle or wooded. Capability unit IIIw-5; woodland suitability group 3w1.

Appleton Series

The Appleton series is made up of deep, somewhat poorly drained, medium-textured soils that formed in moderately calcareous mixed glacial till. These soils are level to gently sloping and are in areas where runoff is slow or areas that receive runoff from higher adjacent slopes. The areas are in the northeastern part of the county.

In a representative profile, in a cultivated area, the surface layer is very dark grayish-brown gravelly silt loam 9 inches thick. The subsurface layer is grayish-brown loam, about 9 inches thick, that is friable and has many distinct mottles. At a depth of 18 inches, this layer merges and interfingers into the upper part of the subsoil, which is neutral, olive-brown gravelly silt loam about 8 inches thick. This part of the subsoil is also distinctly mottled and friable. At a depth of 26 inches, the subsoil is dark grayish-brown to grayish-brown, firm gravelly heavy loam. This material, which is in a layer about 14 inches thick, is neutral in reaction and has many distinct mottles. It is slightly higher in content of clay than the layers above and below. The substratum of firm, mottled grayish-brown gravelly loam is at a depth of 40 inches and extends to a depth of 50 inches or more. It is calcareous.

Appleton soils have a seasonally high water table that limits use for crops. Early in the growing season and during rainy periods later in the year, free water is close to the surface in places. Rooting depth is 15 to 18 inches early in the season, but as the water table recedes a few roots extend to a greater depth. Available water capacity is moderate. If drainage facilities and management practices are good, these soils can equal the drier associated soils in crop production. Permeability is moderately slow in the lower part of the subsoil and in the substratum. Natural fertility is moderately high. Lime needs generally are minimal.

Representative profile of Appleton gravelly silt loam, 0 to 3 percent slopes, in a cultivated field in the town of Perry on Brown Road, 300 feet south of its junction with Cowie Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam, light brownish gray (10YR 6/2) dry; moderate, fine, granular structure; very friable; many fine roots; 15 percent gravel; slightly acid, abrupt, smooth boundary.

A2—9 to 18 inches, grayish-brown (10YR 5/2) loam; many, distinct, light olive-brown (2.5Y 5/4 and 5/6) and dark yellowish-brown (10YR 4/4) mottles; weak, medium, subangular blocky structure that tends toward weak, medium, platy; friable; few fine roots; many fine pores; 10 percent gravel; slightly acid; clear, wavy boundary.

B&A—18 to 26 inches, olive-brown (2.5Y 4/4) gravelly silt loam; many fine, distinct, yellowish-brown (10YR 5/6) and gray (5Y 6/1) mottles; moderate, medium, subangular block structure; friable; few roots in upper part; grayish-brown (2.5Y 5/2) silt coats and patchy clay films on ped faces; common fine pores; 15 percent coarse fragments; neutral; clear, wavy boundary.

B2t—26 to 40 inches, dark grayish-brown (2.5Y 4/2) to grayish-brown (2.5Y 5/2) gravelly heavy loam; many, fine, distinct, light olive-brown mottles; nearly continuous, gray (5Y 5/1) clay films on ped faces; moderate, coarse, subangular blocky structure; firm; common fine pores; 15 percent coarse fragments; neutral; clear, wavy boundary.

C—40 to 50 inches, grayish-brown (2.5Y 5/2) gravelly loam; few, medium, distinct, light olive-brown (2.5Y 5/6) mottles; weak, medium to thick, platy structure; firm; 20 percent coarse fragments; calcareous; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. Bedrock generally is at a depth of 10 to 30 feet, but it is as shallow as 40 inches in places. The content of coarse fragments, by volume, ranges from 5 to 20 percent in the upper part of the solum and from 10 to 30 percent in the lower part. The upper part of the solum ranges from medium acid to neutral in reaction, and the lower part ranges from slightly acid to mildly alkaline.

The A1 or Ap horizon has a hue of 10YR or 2.5Y, a value of 3 or 4, and a chroma of 2. The value is 6 when dry.

The A2 horizon has a hue of 7.5YR to 2.5Y, a value of 5 or 6, and a chroma of 2 or 3. It ranges from fine sandy loam to silt loam. This horizon has weak platy or subangular blocky structure. Common to many high-chroma mottles are in this horizon.

The B horizon has a hue of 7.5YR to 5Y, a value of 3 to 5, and a chroma of 2 to 4. The ped coatings have a chroma of 2. This horizon is loam to silt loam, and the content of clay ranges from 18 to 27 percent. This horizon has weak or moderate subangular blocky or prismatic structure. Consistence is friable or firm. Common to many high-chroma mottles are in this horizon, and distinct clay films are in pores and on ped surfaces. One of the horizons between the Ap horizon and a depth of 30 inches is dominated by a chroma of more than 2.

The C horizon generally is sandy loam or loam. The content of coarse fragments, by volume, ranges from 15 to 35 percent. The upper part of the C horizon is mildly alkaline in places, and it generally is calcareous within a few inches below the solum. Coarse fragments are dominantly a mixture of hard dark shale and limestone fragments.

Some of the Appleton soils in Wyoming County have a thicker solum than that recognized for the series. This difference does not affect the usefulness or behavior of these soils.

Appleton soils are closely associated with the better drained Conesus and Lansing soils and the wetter Lyons soil that formed in similar material. They are also similar to somewhat poorly drained Burdett, Darien, and Erie soils. Appleton soils have a coarser textured Bt horizon than Burdett and Darien soil, and they lack the fragipan that is in Erie soils.

Appleton gravelly silt loam, 0 to 3 percent slopes (ApA).—This soil has the profile described as representative for the series. It is nearly level and is on the glacial till plain and plateau foot slopes where the till contains significant amounts of limestone. It generally receives runoff from adjacent, better drained Lansing or Conesus soils. Surface water drains slowly but more quickly than on depressional, wetter areas in the same general vicinity. Individual areas range from 10 to 40 acres in size.

Included with this soil in mapping were spots of Burdett soils. Also included, in a few depressional areas or drainageways, were areas of Lyons soils.

This Appleton soil is used for dry beans, sweet corn, and crops used in dairy operations. It commonly needs artificial drainage if it is managed at a high level. Response to tile drainage generally is good. Harvesting in fall, during above normal rainfall periods, is more difficult than on adjacent, more sloping soils. Capability unit IIIw-I; woodland suitability group 3w1.

Appleton gravelly silt loam, 3 to 8 percent slopes (ApB).—This gently sloping soil has concave slopes and is at the base of drier soils with high slope gradients. It receives a large amount of runoff and seep from these higher areas. Individual areas are long and narrow and generally follow foot-slope contours. Individual areas are about 20 acres in size.

Included with this soil in mapping, on more convex rises, were areas of moderately well drained Conesus soils. Also included were areas of Burdett soils.

This Appleton soil is used for crops that support dairy operations. Because it is at the lower edge of soils that contribute runoff and ground-water seep, water-control measures are needed for good crop response. The hazard of erosion is slight if this soil is cultivated and not protected. Harvesting in fall, during above normal rainfall periods, is more difficult than on higher, drier slopes. Capability unit IIIw-5; woodland suitability group 3w1.

Arkport Series

The Arkport series consists of deep, well-drained, medium-textured soils that formed in sandy lacustrine deposits. These soils are gently sloping to steep. They are scattered throughout the northern half of the county and are also on the side slopes of the Genesee Valley in the southeastern part.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown very fine sandy loam 9 inches thick. The subsurface layer is yellowish-brown to brown very fine sandy loam about 12 inches thick. Reaction ranges from strongly acid in the upper part of the subsurface layer to medium acid in the lower part. Between depths of 21 and 46 inches is pale-brown loamy very fine sand interspersed with horizontal bands of dark yellowish-brown very fine sandy loam. These bands are about 1 inch thick and are at intervals of 2 to 4 inches. They contain slightly more clay than the soil material between the bands. The substratum, from a depth of 46 to 60 inches or more, is calcareous, grayish-brown, stratified loamy fine sand, very fine sand, and coarse silt.

Arkport soils are among the easiest soils in the county to cultivate because of the very fine sandy loam texture and lack of coarse fragments. Good drainage and the porosity of these soils permit excellent root penetration and development. Free water recedes from the upper layers rapidly in the spring, making these soils among the earliest in the county that are ready for tillage. The slightly heavier textured bands in the subsoil cause these otherwise somewhat droughty soils to have moderate available water capacity. Permeability is rapid in the interband areas and moderate in the bands. Natural fertility is moderately low to low, but the soils respond well to fertilizer. Lime needs are moderate to high.

Representative profile of Arkport very fine sandy loam, 2 to 8 percent slopes, in a cultivated field in the town of Covington, on Brownell Road, 1 mile north of the hamlet of Pearl Creek:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) very fine sandy loam; weak, fine, granular structure; very friable; many roots; many fine pores; strongly acid; abrupt, smooth boundary.

A21—9 to 15 inches, yellowish-brown (10YR 5/4–5/6) very fine sandy loam; very weak, fine, granular structure; very friable; common fine roots; many pores; strongly acid; clear, wavy boundary.

A22—15 to 21 inches, brown (10YR 5/3) very fine sandy loam; weak, fine, subangular blocky structure; friable; few fine roots; common pores; medium acid; clear, wavy boundary.

A&Bt—21 to 46 inches, pale-brown (10YR 6/3) loamy very fine sand; single grain; very friable; lamellae approximately 1 inch thick at intervals of 2 to 4 inches consisting of dark yellowish-brown (10YR 4/4) very fine sandy loam (16 percent clay); weak to moderate, fine, subangular blocky structure; friable; bands become more widely spaced with depth; clay bridged lamellae are 7 inches in diameter; few fine roots in upper part; slightly acid to neutral; porous; gradual, wavy boundary.

C—46 to 60 inches, grayish-brown (10YR 5/2) stratified layers of loamy fine sand, very fine sand, and coarse silt; firm in place; loose when removed; calcareous; moderately alkaline.

The solum ranges from 3½ to 8 feet in thickness. Bedrock is at a depth of 6 feet or more. Carbonates are at a depth of 3 to 10 feet. The solum is strongly acid or medium acid in the upper part and slightly acid to neutral in the lower part. The content of coarse fragments in the solum is less than 5 percent. The median particle size, near the fine or very fine sand limit, is the dominant texture throughout.

The Ap horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 2 or 3.

The A2 horizon has a hue of 10YR or 7.5YR, a value of 4 or 5, and a chroma of 3 to 6. This horizon is dominantly very fine sandy loam, but it ranges to loamy very fine sand.

Range of color in the A&Bt horizon is similar to that of the A2 horizon, except that color in the Bt part is in the darker part of the range.

The C horizon has a hue that centers on 10YR, a value of 4 to 6, and a chroma of 2 to 4.

Arkport soils are near Allard soils. They are less silty in the solum than Allard soils and lack the gravelly IIC horizon at a depth of less than 40 inches that is characteristic of Allard soils. These soils are commonly near Howard and Palmyra soils that differ from Arkport soils in being gravelly.

Arkport very fine sandy loam, 2 to 8 percent slopes (ArB).—This gently undulating soil has the profile described as representative for the series. Individual areas are less than 20 acres in size. They are mostly irregular in shape, but some are oblong and are oriented in a northeastern to southwestern direction.

Included with this soil in mapping were spots of coarser textured soils that lack dark yellowish-brown loamy bands in the subsoil and areas of more silty Allard soils. Also included were small spots of soils that contain some gravel on the surface and in the subsoil.

This Arkport soil is suited to crops, pasture, or woodland. It is well suited to crops that are planted early in spring. It tends to be somewhat droughty during dry periods. Intensively cultivated areas that are not protected by vegetation are susceptible to soil blowing and water erosion. This soil is commonly low in plant nutrients and lime. It responds well to fertilizer and lime. Periodic additions of organic matter by plowing under vegetation or adding manure increases the available water capacity. This is an important soil for farming, even though it is small in size. Capability unit IIe–3; woodland suitability group 2o1.

Arkport very fine sandy loam, 8 to 15 percent slopes (ArC).—This moderately sloping soil has a profile similar to the one described as representative for the series, but the surface layer is thinner in places and contains less organic matter. This soil has short, irregular, convex slopes that receive little or no runoff. Individual areas are irregular in shape and range from 5 to 50 acres in size. Most areas are free of stones and gravel.

Included with this soil in mapping were areas of sand-capped Howard soils and silty Allard soils. Also included were areas of a coarser textured soil that does not contain the dark yellowish-brown loamy bands in the subsoil. In addition a few small areas of soils that have some gravel on the surface or in the subsoil and some small seep spots and drainways were included.

This Arkport soil is suitable for crops, pasture, or trees. Because of slope and rapid runoff, this soil tends to be droughty. If cultivated and not protected by vegetation, it is susceptible to water erosion and soil blowing. This soil frequently is low in lime. It responds well to applications of fertilizer and lime. Periodic additions of organic matter by plowing under vegetation, crop residue, or farm manure increases available water capacity. Because of slope and complex topography, this soil is limited for farming. Capability unit IIIe–3; woodland suitability group 2o1.

Arkport very fine sandy loam, 15 to 25 percent slopes (ArD).—This soil has a profile similar to the one described as representative for the series, but in places it has a thinner surface layer and contains less organic matter. It is moderately steep and is on valley sides. Slopes generally are short and somewhat irregular. Individual areas are irregular in shape or roughly rectangular. They range from about 10 to 100 acres in size.

Included with this soil in mapping were spots of silty Allard soils. Also included were areas of sand-capped gravel and a coarser textured sandy soil that does not have medium-textured bands in the subsoil. Other inclusions were small drainways, gravel spots, seep spots, and eroded spots.

This Arkport soil is mostly wooded or in permanent pasture. Because of slope and the hazard of erosion, it is suited to only limited cultivation. If cultivated, it is very susceptible to water erosion and soil blowing. This soil is droughty and commonly is low in plant nutrients and lime. To produce good pasture, lime and fertilizer should be applied frequently. Capability unit IVe–3; woodland suitability group 2r1.

Arkport very fine sandy loam, 25 to 40 percent slopes (ArE).—This soil has a profile similar to the one described as representative for the series, but the surface layer and subsurface layer are more variable in thickness. This steep soil is on sides of valleys. Slopes generally are short and somewhat irregular. Individual areas are irregular in shape or are long and narrow. The areas range from about 10 to 100 acres in size.

Included with this soil in mapping were areas of silty Allard soils. Also included were areas of sand-capped, gravel soils and a coarser textured sandy soil that does not have loamy bands in the subsoil. Also included were small drainways, gravel spots, wet spots, and eroded spots.

This droughty Arkport soil is mostly wooded. Trees generally have sufficient moisture for good growth. Because of steepness and susceptibility to water erosion and soil blowing, this soil has severe limitations for farming. Capability unit VIe–4; woodland suitability group 2r1.

Arnot Series

The Arnot series is made up of shallow, well drained and moderately well drained, medium-textured soils that formed in acid-mixed till derived mainly from sandstone. These gently sloping to moderately sloping soils are on uplands in the central and north-central parts of the county.

In a representative profile the surface layer is dark grayish-brown channery silt loam 8 inches thick. The upper part of the subsoil is a layer of yellowish-brown channery silt loam that extends to a depth of 13 inches. This layer is friable, strongly acid, and contains many sandstone fragments. The lower part of the subsoil, between depths of 13 and 15 inches, is brown to dark-brown very channery silt loam. It is friable and contains many sandstone fragments. Hard, grayish-brown sandstone bedrock is at a depth of about 15 inches.

In Arnot soils the rooting depth is 10 to 20 inches because of the shallowness to bedrock. Available water capacity depends on the depth to bedrock, but it generally is very low to low. Droughtiness is a limitation in places because of the shallowness of the root zone and the depth to bedrock. Because of this, early season crops are better suited in those areas than are later season crops. Permeability of the soil above the bedrock is moderate to moderately rapid. Natural fertility is low. Lime needs are high for some crops. Because of the large amount of coarse fragments and the shallowness to bedrock, some tillage operations are limited.

Representative profile of Arnot channery silt loam, 2 to 8 percent slopes, in an idle field in the town of Bennington, 50 feet west of Sierk Road at the junction of Cotton Hill Road and Sierk Road:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, fine and medium, granular structure; friable; many fine roots; 20 percent coarse fragments; strongly acid; abrupt, smooth boundary.

B21—8 to 13 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, fine, subangular blocky structure; friable; few fine roots; many fine pores; 35 percent coarse fragments; strongly acid; clear, wavy boundary.

B22—13 to 15 inches, brown to dark-brown (10YR 4/3) very channery silt loam; weak, medium, platy structure; friable; few fine roots; many fine pores; 50 percent coarse fragments; strongly acid; abrupt, smooth boundary.

R—15 inches, hard, grayish-brown sandstone bedrock.

The solum ranges from 10 to 20 inches in thickness and corresponds to the depth to bedrock. Content of coarse fragments, dominantly flat stones, ranges from 35 to 50 percent, by volume, above the bedrock. The solum is silt loam or loam. The solum ranges from strongly acid to very strongly acid.

Present in undisturbed areas is an A1 horizon that is very dark brown (10YR 2/2) and is 1 to 3 inches thick and an A2 horizon that is light brownish gray (10YR 6/2) and is 3 to 4 inches thick.

The B horizon has a hue of 7.5YR to 2.5Y, a value of 4 to 6, and a chroma of 3 to 6.

A very thin C horizon is in some profiles. It consists of very channery loam. Few to common, distinct, brown mottles (7.5YR 5/4) are above the bedrock in places.

Arnot soils are closely associated with moderately deep, well-drained Lordstown soils and shallow, somewhat poorly drained to poorly drained Tuller soils that formed in similar material.

Arnot channery silt loam, 2 to 8 percent slopes (AtB).—This soil has the profile described as representative for the series. It is gently sloping and has slightly convex slopes. It is in the upland till areas. This soil generally receives little or no runoff from upper adjacent slopes. Individual areas are irregular in shape and range from 5 to 30 acres or more in size.

Included with this soil in mapping were small, nearly level areas of this soil. Also included were small areas of somewhat poorly drained Tuller soils in slight depressions. These areas are indicated on the soil map by the symbols for wet spot and field drainageway. A few areas of deeper Lordstown soils were also included. Many ledges of rock outcrop occur. These areas are indicated on the soil map by the symbol for bedrock escarpment.

This Arnot soil is used for corn, oats, hay, and other crops associated with dairying, but tillage is difficult because of the shallowness to bedrock and the few rock outcrops. Long-term hay and pasture are better uses of this soil. Frequent applications of fertilizer are needed to overcome low natural fertility. In years of little rainfall, however, droughtiness prevents efficient use of fertilizer. The hazard of erosion is slight if this soil is cultivated and not protected. Capability unit IIIe–7; woodland suitability group 4d1.

Arnot channery silt loam, 8 to 15 percent slopes (AtC).—This soil is moderately sloping and in places receives some runoff from adjacent soils. It is on uplands and in places forms upper parts of valley walls. Individual areas vary in shape and range from 8 to 30 acres or more in size.

Included with this soil in mapping were ledges of Rock outcrop that are more extensive than in the lesser sloping Arnot soils. Also included were areas of a soil that is less than 10 inches thick and small areas of steeper Arnot soils. A few spots of similar but moderately deep Lordstown soils were also included.

Many areas of this Arnot soil are wooded, idle, or are used for pasture. Tilled crops can be grown in some areas, but the shallowness to bedrock, the few rock outcrops, and the slope are limitations. Droughtiness is less of a limitation on this soil than on the less sloping Arnot soils. Erosion is a slight hazard. Capability unit IVe–2; woodland suitability group 4d1.

Aurora Series

The Aurora series is made up of moderately deep, moderately well drained, loamy soils that formed in medium-lime glacial till derived mainly from underlying shale. These soils are moderately sloping and are on glaciated side slopes in the northern part of the county.

In a representative profile the surface layer is dark garyish-brown shaly silt loam 8 inches thick. The subsurface layer of brown silt loam extends to a depth of 11 inches. From a depth of 11 to 15 inches, this leached layer interfingers into the top of the subsoil. The upper part of the subsoil, from a depth of 15 to 26 inches, is firm, olive-brown shaly silty clay loam that contains a few faint mottles. The surface layer, subsurface layer, and the upper part of the subsoil are slightly acid. The lower part of the subsoil extends to a depth of 31 inches. It is firm, olive-brown to olive shaly heavy loam that contains a few distinct mottles and is mildly alkaline. Below a depth of 31 inches is olive to dark grayish-brown, brittle shale bedrock that is weakly calcareous.

In Aurora soils, rooting depth is mainly 20 to 30 inches, depending on the depth to bedrock. A temporary high water table is at a depth of less than 18 inches. Permeability is slow. Available water capacity varies with depth to bedrock, but it generally is moderate. Natural fertility is medium.

Representative profile of Aurora shaly silt loam, 8 to 15 percent slopes, in a cultivated field in the town of Middlebury, on County Road No. 7, one-half mile northwest of the village of Wyoming:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) shaly silt loam; moderate, medium, granular structure; friable; many fine roots and pores; 15 percent shale fragments; slightly acid; abrupt, smooth boundary.

A2—8 to 11 inches, brown (10YR 5/3) silt loam; weak, fine and medium, subangular blocky structure; friable; common fine roots and pores; 10 percent shale fragments; slightly acid; clear, wavy boundary.

B&A—11 to 15 inches, dark-brown to brown (10YR 4/3) silt loam; moderate, fine and medium, subangular blocky structure; friable; distinct brown (10YR 5/3) silt coats interfingering around peds; common fine roots; common pores; 10 percent shale fragments; slightly acid; clear, wavy boundary.

B2t—15 to 26 inches, olive-brown (2.5Y 4/4) shaly silty clay loam; few, medium, faint, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; few fine roots along ped faces; clay films in pores; distinct clay films on ped faces in lower part; 15 percent shale fragments; neutral; clear, wavy boundary.

B3—26 to 31 inches, olive-brown (2.5Y 4/4) to olive (5Y 4/3) shaly heavy silt loam; few, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak to moderate, medium, subangular blocky structure; firm; discontinuous clay films on ped faces; 25 percent shale fragments; mildly alkaline; abrupt, smooth boundary.

R—31 to 40 inches, olive (5Y 4/3) to dark grayish-brown (10YR 4/2) brittle shale bedrock; fissile; weakly calcareous; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness and closely corresponds to the depth to bedrock. The solum ranges from silt loam to light silty clay loam and averages 18 to 35 percent clay. It ranges from slightly acid to mildly alkaline. The content of shale fragments ranges from 15 to 30 percent, by volume.

The Ap horizon has a hue that is dominantly 10YR, a value of 3 or 4, and a chroma of 2 or 3. The color is darker in areas that are associated with black shale. The texture is shaly silt loam or silt loam and contains some shale fragments.

The A2 horizon has a hue of 10YR, a value of 5 or 6, and a chroma of 3 or 4. This layer is absent or mixed with the Ap horizon in places.

The B horizon has a hue of 10YR to 5Y, a value of 3 to 5, and a chroma of 3 or 4. Faint mottles are at a depth of 15 inches in places. They are common and distinct in the lower part of the B horizon, and chroma is dominantly 2.

Aurora soils are closely associated with similar, but wetter, Angola soils on adjacent landscapes. They are also near similar Danley and Darien soils, which have bedrock at a depth of more than 40 inches. Aurora soils are similar to Manlius soils but have more clay in the B horizon, contain less shale, and are less acid than these soils.

Aurora shaly silt loam, 8 to 15 percent slopes (AuC).—This is the only Aurora soil mapped in the county. It is moderately sloping and generally has smooth, convex slopes.

Included with this soil in mapping were areas of Angola soils along drainageways and on lower concave foot slopes. Also included were Danley soils in areas where bedrock is at a depth of more than 40 inches.

This Aurora soil is suited to crops, pasture, or trees; but the hazard of erosion is moderate, and the use of large machinery is limited by slope. Capability unit IIIe-4; woodland suitability group 2o2.

Bath Series

The Bath series is made up of deep, well-drained soils that formed in acid, loamy glacial till derived mainly from sandstone and shale. These soils are nearly level to steep and are on the higher areas of the plateau in the north-central and eastern parts of the county and on lower areas in an area bounded by the villages of Warsaw and Silver Springs on the east and Varysburg, North Java, and Bliss on the west.

In a representative profile the surface layer is dark grayish-brown channery silt loam 9 inches thick. The upper part of the subsoil is a layer of yellowish-brown, friable channery loam that extends to a depth of 24 inches. Between this layer and the lower part of the subsoil is a leached layer of firm grayish-brown channery loam, about 5 inches thick, that has a few distinct mottles. The lower part of the subsoil is a dark-brown to brown, very firm and brittle, channery loam fragipan that extends to a depth of 46 inches. The firm glacial till substratum is light olive-brown flaggy loam that extends to a depth of 58 inches or more. Reaction is strongly acid below the surface layer.

Bath soils are very acid and have low natural fertility. Permeability is moderate in the surface layer and in the upper part of the subsoil, and these layers have good aeration. Permeability is slow in the fragipan, but the fragipan in these soils generally is more porous and not so restrictive to root and water penetration as the fragipan of wetter soils. Available water capacity is moderate. Most crops show a moisture deficiency in 8 to 12 rain-free days. These soils contain many hard channery, flaggy, and large flat sandstone fragments, especially in the substratum.

Representative profile of Bath channery silt loam, 3 to 8 percent slopes, in an abandoned apple orchard in the town of Castile, 2 miles south of the village of Perry along Upper Reservation Road.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) channery silt loam; weak, medium and fine, granular structure; very friable; many roots; 25 percent coarse fragments; medium acid; abrupt, smooth boundary.

B2—9 to 24 inches, yellowish-brown (10YR 5/4) channery loam; weak, fine and medium, subangular blocky structure; friable; common roots; porous; 20 percent coarse fragments; strongly acid; clear, smooth boundary.

A'2—24 to 29 inches, grayish-brown (2.5Y 5/2) channery loam; weak, thick, platy structure; firm, brittle; few, medium, distinct, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles on borders of peds; few fine roots; many fine and medium pores; 25 percent coarse fragments; strongly acid; clear, irregular boundary.

B'x—29 to 46 inches, dark-brown (10YR 4/3) channery loam; weak, very coarse prisms separated by grayish-brown (2.5Y 5/2) loam wedges ½ to 1½ inches wide at top tapering to films at the bottom; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles within wedges; weak thick plates in prisms; very firm, brittle; few roots; many fine pores; clay linings in some pores; 30 percent coarse fragments; strongly acid; gradual, wavy boundary.

C—46 to 58 inches, light olive-brown (2.5Y 5/4) flaggy loam; weak, thick, platy structure; very firm; 30 percent coarse fragments; strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock ranges from 40 inches to many feet. Content of coarse

fragments, mainly flat sandstone and siltstone, ranges from 0 to 30 percent in the A horizon and from 20 to 40 percent in the Bx and C horizons. The upper 20 to 40 inches of unlimed soil is strongly acid or very strongly acid, but in places soils are calcareous at depths of more than 70 inches.

The Ap horizon ranges from grayish brown (10YR 5/2) to very dark grayish brown (10YR 3/2). It is channery or gravelly silt loam or loam. This horizon has weak to moderate granular structure, and reaction is strongly acid to neutral, depending upon liming.

The B2 horizon ranges from light olive brown (2.5Y 5/6) or olive brown (2.5Y 4/4) to brown (7.5YR 4/3 to 5/4). It has very weak blocky or granular structure, and it is silt loam or loam.

The A2 horizon has a hue of 2.5Y to 7.5YR, a value of 5 or 6, and a chroma of 2 to 4. This horizon ranges from sandy loam to silt loam. It is massive or has weak platy or very weak blocky structure, and it is firm in consistence. It ranges from very strongly acid to medium acid in reaction.

The Bx horizon is at a depth of 18 to 34 inches. This horizon is olive gray and ranges from loam to silt loam. It has moderate, very coarse, prismatic structure with vertical cleavage spaced from 1 to 2 feet apart. In places this horizon has platy structure or is massive. Consistence is firm or very firm. Mottles are commonly absent, but where present they are few to common, faint to distinct, and in places are in the zones that separate prisms of the fragipan.

The C horizon is similar to the Bx horizon in color and texture, but it lacks the prismatic structure and is less brittle.

Bath soils are in a drainage sequence with moderately well drained Mardin soils and somewhat poorly drained Volusia soils that formed in similar materials. Bath soils are near Chenango, Langford, Lordstown, Valois, and a channery phase of Williamson soils. They have a fragipan that is lacking in Chenango soils; and they formed in firm till rather than the gravelly outwash deposits in which Chenango soils formed. Bath soils are more acid in the Bx horizon and are better drained than the similar Langford soils. They are more than 40 inches thick over bedrock in contrast to Lordstown soils, which have sandstone bedrock at a depth of about 28 inches. Both soils have a fragipan that is lacking in the otherwise similar Valois soils. They are better drained and formed in deep till deposits in contrast to the thin till over silt regolith of the channery phase of the Williamson soils.

Bath channery silt loam, 0 to 3 percent slopes (BaA).—This soil has a profile similar to the one described as representative for the series, but in places it has a somewhat thicker and darker plow layer and has more mottling in the lower part of the subsoil. This soil is nearly level and generally is on the higher plateaus. It receives little or no runoff from adjacent slopes. Moisture relationships generally are a little more favorable in this soil than in other Bath soils. Individual areas range from 5 to 50 acres in size.

Included with this soil in mapping were a few areas of moderately well drained Mardin soils. Also included were small areas of wetter Mardin and Volusia soils that require drainage if the soil is tilled as early as an area of the well-drained soils. These areas are intermingled with this Bath soil in an extensive area between the villages of Castile and Perry.

This Bath soil can be used for early-season crops, such as potatoes or peas. Stone fragments are dominantly flat and separate well from potatoes on inclined table potato harvesters. Equipment breakage on these harvesters limits their use. Capability unit I–1; woodland suitability group 3o1.

Bath channery silt loam, 3 to 8 percent slopes (BaB).—This soil has the profile described as representative for the series. It is gently sloping or undulating and is on convex slopes on the higher plateaus. It receives little or no runoff from adjacent soils. The adjacent soils are the nearly level Bath or Mardin soils on areas of the same general elevation, or steeper areas of these soils. Individual areas vary in size.

Included with this soil in mapping were areas of moderately deep Lordstown soils and similar, but wetter, Langford and Mardin soils. Also included were areas of Mardin and Volusia soils along drainageways and in depressional areas. These spots require drainage if they are to be cultivated with the Bath soils on the slightly higher parts of the area.

This Bath soil can be used for early-season crops, such as potatoes or peas. Other row crops are also commonly grown on this soil. Erosion is a slight hazard. Stone fragments are dominantly flat and separate well from potatoes on inclined-table potato harvesters, but equipment breakage is a limitation. Capability unit IIe–2; woodland suitability group 3o1.

Bath channery silt loam, 8 to 15 percent slopes (BaC).—This soil is moderately sloping and is on the higher areas of the plateau. It commonly is in long areas on ridges or sides of ridges and is associated with higher, gently sloping Bath soils and lower and steeper Bath or Mardin soils. Some runoff water, although the amount is not excessive, is received by this soil from adjacent higher soils.

Included with this soil in mapping were moderately deep Lordstown and areas of similar, but wetter, Langford and Mardin soils.

This Bath soil is used for grain and hay crops at least half of the time, but some areas are used for row crops. The hazards of erosion and runoff are moderate. Use of large tillage and harvesting equipment is difficult. Capability unit IIIe–2; woodland suitability group 3o1.

Bath channery silt loam, 15 to 25 percent slopes (BaD).—This soil has a profile similar to the one described as representative for the series, but in places the plow layer and the upper part of the subsoil are thinner. This soil is moderately steep and is on side slopes of the plateau and also in some long areas on ridges. Individual areas are about 30 to 60 acres in size.

Included with this soil in mapping were areas of moderately deep Lordstown and similar, but wetter, Langford and Mardin soils.

Large areas of this Bath soil are wooded. Some areas are in low intensity farming, and others are idle. Runoff is rapid, and the hazard of erosion is a serious concern, but this soil resists erosion better than most similarly sloping soils. Use of tillage equipment is difficult, and it is almost impossible to use larger machines. Capability unit IVe–1; woodland suitability group 3r1.

Bath channery silt loam, 25 to 40 percent slopes (BaE).—This soil has a profile similar to the one described as representative for the series, but it lacks the deep plow layer because most areas are wooded. In some cleared areas only a thin remnant of the original surface layer remains. This steep soil is on side slopes of the plateau. Most areas are in an area extending from Warsaw to Attica. Individual areas generally are long and narrow and range from 10 to 70 acres in size.

Included with this soil in mapping were areas of more gravelly Valois soils, especialy in dissected areas near Letchworth State Park. Also included were areas of moderately deep Lordstown soils and similar, but wetter, Langford and Mardin soils. The hard bedrock in the Lordstown soils is nearer the surface than that of this soil and the

other included soils. Also included, in the northwestern corner of the county, were some areas of steep Bath soils that contain shale rather than sandstone fragments.

This Bath soil should be left as woodland or permanent pasture if some nutrient amendments can be applied. If cleared, runoff and erosion are severe hazards. Capability unit VIe-1; woodland suitability group 3r1.

Bath-Valois gravelly loams, 0 to 3 percent slopes (BlA).—This complex consists of nearly level soils on morainic deposits. The landscape resembles the tops of mesas. Steeper and similar soils are on the adjacent side slopes of these landforms. Bath and Valois soils are intermingled in delineated areas. About 60 percent of the complex is Bath soils, and the remaining 40 percent is Valois soils.

The Bath soil has a profile similar to the one described as representative for the Bath series, but most of the fragments are more rounded than flat. Also, stratified sand and gravel is commonly at a depth of 4 to 8 feet. The Valois soil has a profile similar to the one described as representative for the Valois series. The two soils in this complex are almost identical in appearance in the surface layer and the upper part of the subsurface layer, but Valois soils lack a fragipan, and they are more loose and open in the lower part.

The areas of this complex can be used for early-season crops, such as potatoes or peas. Stone fragments interfere with the mechanical harvesting of potatoes. Capability unit I-1; woodland suitability group 3o1.

Bath-Valois gravelly loams, 3 to 8 percent slopes (BlB).—This complex consists of gently sloping or undulating soils on moraines. Individual areas range from 5 to about 150 acres in size. About 55 percent of the unit is Bath soil, and the remaining 45 percent is Valois soil.

The Bath soil has a profile similar to the one described as representative for the Bath series, but most of the fragments are more rounded than flat. Also, stratified sand and gravel is commonly at a depth of 4 to 8 feet. The Valois soil has the profile described as representative for the Valois series.

Included with this complex in mapping were areas of soils that have thin, 2 to 3 feet thick, gravel deposits underlain by firm basal till. These areas were at higher elevation in the towns of Orangeville and Wethersfield. Also included were large areas of Williamson channery silt loam along valley sides. In these included spots the substratum consists of thick silt layers, which causes cut slopes to slump and causes the soil to be subject to differential frost heave.

The areas of this complex can be used for early-season crops, such as potatoes and peas. Cash-grain and dairy crops are also grown. Stone fragments interfere with the mechanical harvesting of potatoes. The hazard of erosion is slight if these soils are cultivated and not protected. Capability unit IIe-2; woodland suitability group 3o1.

Bath-Valois gravelly loams, 8 to 15 percent slopes (BlC).—This complex consists of moderately sloping soils on moraines. The landforms are typically moderately sloping soils on a series of knolls that slope in various directions. Some of the areas are also on the side slopes of overall larger landforms. Individual areas range from 5 to more than 100 acres in size. About 55 percent of the complex is Bath soil, and the remaining 45 percent is Valois soil.

The Bath soil has a profile similar to the one described as representative for the Bath series, but it is more gravelly and commonly has a deep substratum of stratified sand and gravel rather than basal till. The Valois soil has a profile similar to the one described as representative for the Valois series.

Included with this complex in mapping were large areas of Chenango soils where the till mantle is very thin over stratified material. Also included were gently sloping or moderately steep soils that have very short slopes. Other inclusions, near valley sides, were areas of these soils that have thick silty layers in the substratum. In these areas the cut slopes slump, and the soil is subject to differential frost heave.

The areas of this complex can be used for row crops, but this use should be kept to a minimum. The hazard of erosion is moderate if these soils are cultivated and not protected. The irregular slopes limit the use of contour tillage. The few included wet spots need drainage. Capability unit IIIe-2; woodland suitability group 3o1.

Bath-Valois gravelly loams, 15 to 25 percent slopes (BlD).—This complex consists of moderately steep or hilly soils on moraines. The moderately steep soils have simple slopes in one direction, but the hilly soils are in a series of large kamelike knolls that slope in many directions. Individual areas range from 10 to 70 acres in size. Bath soil makes up 50 percent of the unit, and Valois soils, the remaining 50 percent.

The Bath soil has a profile similar to the one described as representative for the Bath series, but it is more gravelly in places and commonly has a deep substratum of stratified sand and gravel rather than basal till. The Valois soil has a profile similar to the one described as representative for the Valois series.

Included with this unit in mapping, mainly on the cone tops of the kamelike areas, were large areas of Chenango soils. Also included were areas of gently sloping or moderately sloping soils that have short slopes. Other inclusions, near valley sides, were areas of these soils that have thick silty layers in the substratum. In these areas cut slopes slump, and the soil is subject to differential frost heave.

The moderately steep soils in this unit are susceptible to erosion and are very difficult and hazardous to cultivate. If used for hay crops, they need large applications of lime and fertilizer. Capability unit IVe-1; woodland suitability group 3r1.

Burdett Series

The Burdett series consists of deep, somewhat poorly drained soils that formed in contrasting deposits. The surface deposit is silty or loamy material that has relatively low density. The underlying deposit, on the other hand, is denser, moderately fine textured, shaly material that formed in calcareous glacial till. These soils are nearly level to gently sloping. They occupy till landscapes in the northern part of the county.

In a representative profile the plow layer is 9 inches of dark grayish-brown silt loam. The upper part of the subsurface layer is distinctly mottled, friable, grayish-brown silt loam that extends to a depth of 19 inches. The lower part is slightly acid, light brownish-gray, friable loam about 8 inches thick. It is distinctly mottled and con-

tains a few stone fragments. Between depths of 27 and 38 inches the subsoil consists of a contrasting layer of firm, dark grayish-brown light silty clay loam that is distinctly mottled and has a noticeable amount of shale fragments. Below 38 inches, down to a depth of 50 or more inches, the firm substratum is olive-gray shaly silt loam that is calcareous.

A seasonally high water table at a depth of 6 to 18 inches restricts most rooting to the surface layer and upper part of the subsurface layer. The soils generally are saturated during seasonally wet periods. Drainage is needed for adequate crop production. The mantle of silty or loamy soil material is moderately permeable, and the finer textured subsoil and substratum are slowly permeable. These soils have moderate available water capacity. Natural fertility is medium to high. Lime needs are moderate to low.

Burdett soils have a seasonally high water table at a depth of 6 to 18 inches that restricts most root depth to the surface layer and upper part of the subsurface layer. These soils generally are saturated in wet periods. Drainage is needed for adequate crop growth. Available water capacity is moderate. Permeability is moderate in the silty or loamy mantle and is slowly permeable in the finer textured subsoil and the substratum. Natural fertility is medium to high. Lime needs are moderate to low.

Representative profile of Burdett silt loam, 0 to 3 percent slopes, in a cultivated field in the town of Perry, 800 feet west-northwest of junction of LaGrange and Brown Roads, southeast of the village of Wyoming:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; many fine roots; 5 percent mixed coarse fragments; slightly acid; abrupt, smooth boundary.

A21—9 to 19 inches, grayish-brown (10YR 5/2) silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine and medium, subangular blocky structure; friable; common fine roots; common fine pores; 3 percent coarse fragments; medium acid; clear, smooth boundary.

A22—19 to 27 inches, light brownish-gray (2.5Y 6/2) loam; many, medium, distinct, light olive-brown (2.5Y 5/6) and brown to dark-brown (10YR 4/3) mottles; weak, fine, subangular blocky structure in upper part and thick platy in lower part; friable; few fine roots; common fine pores; 5 to 10 percent mixed coarse fragments; slightly acid; clear, wavy boundary that interfingers into the upper part of IIB2t horizon.

IIB2t—27 to 38 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam, olive-gray (5Y 4/2) ped interiors; many, medium, distinct, yellowish-brown (10 YR 5/4) and faint olive-brown (2.5Y 4/4) mottles; weak, very thick, platy structure; firm; distinct clay films on ped faces and in pores; 15 percent shale fragments; neutral; clear, smooth boundary.

IIC—38 to 50 inches, olive-gray (5/2) shaly heavy silt loam, olive (5Y 4/3) streaked interiors; common, medium, distinct, gray (N 5/0) and olive-brown (2.5Y 4/4) mottles; moderate, thick, platy structure; firm; 15 to 25 percent soft shale fragments; calcareous; moderately alkaline.

The solum ranges from 30 to 42 inches in thickness. Shale bedrock is at a depth of 3½ to 10 feet. Carbonates are at a depth of 30 to 50 inches. The upper silty or loamy mantle ranges from 15 to 30 inches in thickness.

The A horizon ranges from loam to silt loam. It is low in content of clay and is 0 to 15 percent coarse fragments, by volume.

The Ap horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 2.

The A2 horizon has a hue of 10YR to 2.5Y, a value of 4 to 6, and a chroma of 2 to 4. Common to many, distinct, high-chroma mottles are in this horizon.

The IIB2t horizon has a hue of 10R to 5Y, a value of 3 to 5, and a chroma of 1 to 3. Mottling is distinct. This horizon is loam, clay loam, and silty clay loam and averages 28 to 35 percent clay. Coarse fragments generally are shale and range from 10 to 25 percent, by volume.

Burdett soils are in a drainage sequence with the wetter Ilion and drier Nunda soils. They formed in material similar to that in which these soils formed. Burdett soils are on landscapes similar to those occupied by Angola, Appleton, and Darien soils, all of which lack the silty mantle over till that is in Burdett soils. In Burdett soils depth to bedrock is more than 40 inches, but in Angola soils, it is less than 40 inches. Burdett soils have a finer textured B horizon than that of Appleton soils.

Burdett silt loam, 0 to 3 percent slopes (BuA).—This soil has the profile described as representative for the series. It is nearly level and is in areas that generally receive runoff from adjacent gently sloping soils.

Included with this soil in mapping, in lower adjacent areas, were wet spots of poorly drained Ilion or Lyons soils. Also included were areas of Appleton soils in the thicker mantled ablation till areas and Darien soils in the areas where the coarser textured surface mantle is very thin or lacking.

This Burdett soil is not suited to row crops unless it is artificially drained. Fibrous-rooted legumes and grasses grow well in areas used for hay and pasture crops. Capability unit IIIw-1; woodland suitability group 3w1.

Burdett silt loam, 3 to 8 percent slopes (BuB).—This soil is gently sloping in areas on concave foot slopes or is gently undulating. It receives runoff from adjacent areas that generally are occupied by the better drained Nunda and Conesus soils.

Included with this soil in mapping were areas of Ilion and Lyons soils along drainageways and in small depressions. Also included were areas of undulating Nunda soils on the crests of small knolls.

This Burdett soil can be used for row crops if wet spots are drained. Some seep areas need to be corrected where these soils are at the base of longer slopes. The hazard of erosion is slight if this soil is cultivated and not protected. Capability unit IIIw-5; woodland suitability group 3w1.

Canadice Series

The Canadice series is made up of deep, poorly drained, moderately fine textured soils that formed in moderately calcareous lake-laid deposits. These soils are nearly level or depressional and are along the major valleys in the county.

In a representative profile of a cultivated area, the surface layer is very dark gray light silty clay loam about 9 inches thick. This layer has a few, distinct, yellowish-brown mottles. The upper part of the subsoil, to a depth of 14 inches, is slightly acid, grayish-brown firm silty clay loam that contains many prominent mottles. The lower part, to a depth of 38 inches, is dark-gray, firm silty clay that also contains many prominent mottles. This layer is slightly acid in the upper part and is neutral in the lower part. The substratum is mottled gray silty clay that is slightly lower in clay content than the subsoil. It is firm and calcareous from a depth of 45 inches down to a depth of 50 inches or more.

Canadice soils have a water table at or near the surface

throughout the winter and spring and during excessively wet periods. These soils are subject to occasional ponding. Rooting depth is largely confined to 12 to 14 inches because of the high water table. Available water capacity is moderate. Natural fertility is medium to high. Lime needs are medium to low. Permeability is slow in the surface layer and very slow in the subsoil and substratum. Because these soils are wet and have slow permeability, they have limited value for farming.

Representative profile of Canadice silty clay loam, in a pasture, 2½ miles northeast of village of Warsaw, 150 yards northwest of B&O tracks and County Road No. 7:

Ap—0 to 9 inches, very dark gray (10YR 3/1) light silty clay loam, light gray (10YR 7/2) dry; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; friable, many fine roots; slightly acid; abrupt, smooth boundary.

B21tg—9 to 14 inches, grayish-brown (2.5Y 5/2) silty clay loam; many, medium, prominent, strong-brown (7.5YR 5/6 and 5/8) mottles; moderate, medium and coarse, angular blocky structure; firm, slightly plastic; common fine roots; few fine pores; patchy gray (10YR 5/1) clay films on ped faces and lining pores; slightly acid; clear, wavy boundary.

B22tg—14 to 25 inches, dark-gray (5Y 4/1) silty clay; many, medium and fine, prominent, strong-brown (7.5YR 5/6 and 5/8) mottles; moderate to strong, coarse prisms that break to moderate, medium and coarse, angular blocky structure; firm, plastic; few roots and pores; continuous gray (10YR 5/1) clay films on ped exteriors; slightly acid; gradual, wavy boundary.

B23tg—25 to 38 inches, dark-gray (5Y 4/1) silty clay; many, medium, prominent, strong-brown (7.5YR 5/6 and 5/8) mottles; moderate, coarse prisms that break to moderate, medium, angular blocky structure; firm, plastic; no roots; continuous gray (10YR 5/1) clay films on ped faces; neutral; gradual, wavy boundary.

C—38 to 50 inches, gray (5Y 5/1) silty clay; common, medium distinct, brown to dark-brown (10YR 4/3) mottles; massive; firm; mildly alkaline in upper part, calcareous and moderately alkaline at a depth of 45 inches.

The solum ranges from 36 to 48 inches in thickness. Carbonates generally are at a depth of 38 inches or more. Reaction is medium acid or slightly acid in the upper part of the solum and neutral in the lower part. The Ap horizon has a hue of 10YR or 2.5Y, a value of 2 or 3, an da chroma of 1 or 2. Colors have a dry value of 6 or higher. A few distinct mottles generally are in this horizon. The B2tg horizon has a hue of 2.5Y or 5Y, a value of 4 or 5, and a chroma of 0 to 2. The texture of the B horizon is silty clay loam or silty clay and ranges from 35 to 60 percent clay. The C horizon is similar in color to the B horizon. Mottles are few to common and faint to distinct. This horizon generally is massive, but it has varves in places. Depth to bedrock is more than 6 feet.

Canadice soils are associated with the drier, more sloping Caneadea soils that formed in similar material. They commonly are near Wayland, Teel, and Wallkill soils that are on nearby flood plains. Canadice soils have a higher clay content in the B horizon than these soils.

Canadice silty clay loam (Ca).—This nearly level soil is in flat areas or in slight depressions within old glacial lake basins. Individual areas are long and narrow, or they are oblong. They range from 10 to 50 acres in size. These areas are subject to ponding in spring and after heavy rains.

Included with this soil in mapping were areas of the Caneadea, Wallkill, and Wayland soils. Caneadea soils are drier than this Canadice soil and occupy slightly elevated areas. The wetter Wallkill soils contain less clay in the upper part of the subsoil than this soil and are underlain by muck. These wetter inclusions generally are indicated on the soil map by the symbols for drainageway and wet spot. Also included were Wayland soils along the first bottom areas and areas of Canadice soils, adjacent to alluvial fans, that contain a gravelly substratum in places. Areas of soils that have a silt loam surface layer were also included.

If this Canadice soil is adequately drained, row crops and hay can be grown in places. If it is cultivated, maintenance of tilth is a concern of management. Undrained areas of this soil are better suited to pasture, woodland, or wetland wildlife habitat than to other uses. Generally these soils are difficult to drain; therefore, most areas are used for pasture or woodland. Capability unit IVw-3; woodland suitability group 4w2.

Canaseraga Series

The Canaseraga series is made up of deep, moderately well drained to well drained, acid, medium-textured soils that formed in silty material underlain by firm glacial till deposits. These soils are nearly level to moderately sloping and are in upland till areas and along the valley walls in the southern half of the county.

In a representative profile the surface layer is dark grayish-brown silt loam 8 inches thick. The subsoil, to a depth of 21 inches, is friable, yellowish-brown silt loam that grades to brown at a depth of about 18 inches. Between depths of 21 and 26 inches is a friable, pale-brown very fine sandy loam, leached layer that is faintly mottled. All these layers are strongly acid. From a depth of 26 inches to a depth of 52 inches or more is a dense, very firm fragipan. This material is brown to dark-brown channery loam that is faintly mottled. It is medium acid.

Canaseraga soils have a firm, dense fragipan below the silt mantle that restricts the downward movement of water and creates a temporary water table above the fragipan in spring and after heavy rains. Rooting depth is largely above the fragipan. Available water capacity is high. Permeability is moderate above the fragipan and very slow in the fragipan. Natural fertility is medium to low. Lime needs are high.

Representative profile of Canaseraga silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Gainesville, 2 miles south-southeast of Gainesville, 100 feet northeast of junction of Jordan and Metcalf Roads:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; many roots; strongly acid; clear, smooth boundary.

B21—8 to 18 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; common fine pores; strongly acid; clear, wavy boundary.

B22—18 to 21 inches, brown (10YR 5/3) silt loam; weak, coarse, subangular blocky structure that breaks to weak, thin, platy; friable; few fine roots; common fine pores; strongly acid; clear, smooth boundary.

A'2—21 to 26 inches, pale-brown (10YR 6/3) very fine sandy loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, thin, platy structure; friable; common fine pores; strongly acid; abrupt, irregular boundary.

IIB'x—26 to 52 inches, brown (10YR 5/3) to dark-brown (10YR 4/3) channery loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles; thin streaks, about ½ inch wide, of pale-brown (10YR 6/3) very fine sandy loam extending around 12- to 16-inch prisms that have strong-brown (7.5YR 5/6) borders; weak, very thick, platy structure in prisms; very firm and brittle; few fine pores; 25 percent coarse fragments; medium acid.

The solum ranges from 40 to 60 inches in thickness. The silty mantle ranges from 18 to 36 inches in thickness. Bedrock generally is at a depth of 6 to 20 feet. The mantle ranges from silt loam to very fine sandy loam.

The Ap horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 2 or 3.

The B horizon has a hue of 10YR or 7.5YR, a value of 4 or 5, and a chroma of 3 to 6. Faint mottles are in the lower part of this horizon in places.

The A'2 horizon has a hue of 2.5YR or 10YR, a value of 5 or 6, and a chroma of 2 or 3. Faint to distinct mottles are in this horizon. It ranges from very strongly acid to strongly acid.

The IIB'x horizon is at a depth of 18 to 30 inches. It is in the lower part of the silt mantle and the underlying till or is entirely within the till. It has a hue of 10YR or 2.5Y, a value of 4 or 5, and a chroma of 2 to 4. Few to common, faint to distinct mottles are in this horizon.

The IIB'x horizon ranges from channery loam to channery silt loam. It has weak to moderate, platy structure in prisms. The content of coarse fragments ranges from 15 to 35 percent. This horizon is slightly acid to strongly acid.

The IIC horizon, if present, is similar in color and texture to the IIB'x horizon but generally is lower in chroma. It has weak platy structure or is massive, and consistence is firm or very firm. Reaction ranges from medium acid to neutral.

Canaseraga soils are closely associated with similar but wetter Dalton soils on lower adjacent slopes. They are also near Bath, Langford, Mardin, and Williamson soils, all of which lack the silty mantle underlain by till that is in Canaseraga soils. They occupy landscapes similar to those occupied by these soils.

Canaseraga silt loam, 0 to 3 percent slopes (CcA).—This soil is nearly level and commonly has slightly convex slopes in upland till areas. It receives little runoff from adjacent soils. It is mainly moderately well drained. Individual areas generally are circular and range from 20 to 50 acres in size.

Included with this soil in mapping were spots of wetter, similar Dalton soils in depressions and drainageways. Also included were Mardin soils, Williamson channery silt loam soils, and areas of soils that have stratified silt and till in the substratum.

This stone-free Canaseraga soil is used for cash crops, corn, small grain, hay, pasture, or woodlots. It is easy to cultivate, and crops respond well to adequate applications of fertilizer. In places planting is delayed briefly in spring because of wetness associated with the dense fragipan in the subsoil. Capability unit IIw-2; woodland suitability group 2o1.

Canaseraga silt loam, 3 to 8 percent slopes (CcB).—This soil has the profile described as representative for the series. It is gently sloping and commonly has convex slopes in the upland till areas. This soil receives little runoff from adjacent soils. Individual areas are roughly rectangular or circular and range from 30 to 40 acres in size.

Included with this soil in mapping were areas of Williamson soils that have a channery or gravelly loam surface layer and Williamson soils that have a loamy substratum. The former is in areas of multiple deposits. Also included were similar Dalton soils along drainageways and seepage areas.

This Canaseraga soil is suited to crops, pasture, or woodland. This soil is used mainly for potatoes and, to a lesser degree, for other cash crops. It is also used for corn, small grain, hay, and woodland. The hazard of erosion is moderate to severe if this soil is cultivated and not protected. Crops respond well to adequate application of fertilizer and lime. Because this soil is free of stones, potato harvesters are easy to operate. Capability unit IIe-5; woodland suitability group 2o1.

Canaseraga silt loam, 8 to 15 percent slopes (CcC).—This soil has a profile similar to the one described as representative for the series, except that in this soil the depth to mottling is greater in many places. This moderately sloping soil is in the higher areas of the valleys of the Genesee River and Wiscoy Creek. In most areas this soil is well drained. Individual areas generally are oblong and range from 10 to 30 acres in size.

Included with this soil in mapping were a few areas of steeper soils, especially along the drainageways. Also included were areas of Williamson soils that have a channery or gravelly loam surface layer and Williamson soils that have a loamy substratum. The former soils are in areas of multiple deposits, generally on slopes above Letchworth State Park. Areas of Dalton soils along drainageways were also included.

Most areas of this Canaseraga soil that have been cleared are idle or used for hay or pasture. If this soil is used intensively for crops, measures are needed to control runoff and erosion. Areas of this soil that are within the State Park are wooded and used for wildlife habitat. Capability unit IIIe-6; woodland suitability group 2r2.

Caneadea Series

The Caneadea series is made up of deep, somewhat poorly drained to moderately well drained, nearly level to steep soils. These soils have a medium-textured and moderately fine textured surface layer and a moderately fine textured and fine textured subsoil. They formed in high-lime lacustrine deposits of layered clay and silt. The largest areas are in the headwater area of Buffalo Creek in the western edge of the county and along the lower side slopes of the Tonawanda Valley.

In a representative profile the surface layer is dark grayish-brown silt loam 8 inches thick. The upper part of the subsoil is mottled olive-brown silty clay loam that extends to a depth of about 19 inches. It is medium acid and friable in the upper few inches and firm below. The lower part is mottled, olive-brown to dark grayish-brown, firm silty clay and extends to a depth of 34 inches. It is slightly acid to neutral. A calcareous, mottled, olive-brown, heavy substratum is below a depth of 34 inches. It is made up of thin layers of silt loam, silty clay loam, and silty clay that extend to a depth of 40 inches or more.

Caneadea soils have a high water table at a depth of 1 foot during seasonally wet periods. Natural fertility is medium to high. Available water capacity is moderate. Permeability is slow or very slow below the surface layer. The dense, fine-textured subsoil is underlain by stratified silt, clay, and very fine sand that lack stability on exposed cuts.

Representative profile of Caneadea silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Java, 20 feet north of Day Road and 200 feet west of junction of Day and Sheehe Roads:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many fine roots; medium acid; abrupt, smooth boundary.

B&A—8 to 12 inches, olive-brown (2.5Y 4/4) silty clay loam; common, medium, prominent, strong-brown and gray mottles; moderate, fine and medium, blocky structure; friable; common fine roots; common fine pores; 1-millimeter thick, light olive-brown (2.5Y 5/4) silty

films that have many, medium, distinct, yellowish-brown mottles are on peds; 1 percent gravel; medium acid; clear, wavy boundary.

B21t—12 to 19 inches, olive-brown (2.5Y 4/4) heavy silty clay loam; thin films of grayish-brown (2.5Y 5/2) silt on 90 percent of ped exteriors; many, medium, prominent, yellowish-brown and gray mottles; moderate, coarse prisms that break to moderate, medium and coarse, subangular blocky structure; firm; few fine roots; common fine pores with clay linings; patchy clay films in depressions on faces of peds; few small pebbles; medium acid; gradual, wavy boundary.

B22t—19 to 34 inches, olive-brown (2.5Y 4/4) silty clay; many, coarse, faint and distinct, dark yellowish-brown and gray mottles; dark grayish-brown (2.5Y 4/2) clay films on 20 percent of vertical and horizontal faces of peds; strong, coarse prisms that break to moderate, very coarse and coarse, angular blocky structure; firm; few fine roots on prism faces; common fine pores with clay linings; slightly acid grading to neutral as depth increases; clear, wavy boundary.

C—34 to 40 inches, olive-brown (2.5Y 4/4) layers of silty clay loam, silty clay, and silt loam; common, fine, faint and distinct, brown (10YR 4/3) and gray (5Y 5/1) mottles; moderate, thick, platy structure; faces of peds are gray (5Y 5/1); firm; few pores; calcareous; moderately alkaline.

The solum ranges from 30 to 45 inches in thickness. Bedrock is at a depth of more than 40 inches. Carbonates are at a depth of 30 to 60 inches. Coarse fragments are typically absent, but gravel or erratic stones less than 5 percent, by volume, are present in some areas. The upper part of the solum ranges from very strongly acid to medium acid, and the lower part is slightly acid or neutral.

The Ap horizon has a hue of 2.5Y to 10YR, a value of 3 to 5, and a chroma of 2. This horizon ranges from very fine sandy loam to silty clay loam, and it is friable to firm. Reaction ranges from strongly acid to neutral.

A weak blocky or platy A2 horizon of material similar to the exterior of peds of the A&B horizon is present in some areas. It ranges from unmottled yellowish brown (2.5Y 5/4) to prominently mottled grayish brown (2.5Y 5/2). It is 2 to 6 inches thick and is very strongly acid to medium acid in reaction. The A2 horizon is most conspicuous where the upper 15 inches of soil appears to be in a contrasting deposit.

The silty material around peds is 1 to 4 millimeters thick in the B&A horizon and makes up 15 to 40 percent of this horizon. This material is light olive brown (2.5Y 5/4) to grayish brown (2.5Y 5/2).

The Bt horizon has a hue of 10YR to 5Y in places, but the dominant hue, exclusive of mottles below the B&A horizon, is 2.5Y or yellower. It has a value of 4 or 5 and a chroma of 2 to 4. The average content of clay ranges from 36 to 55 percent in the upper 20 inches of the B horizon. This horizon has medium to very coarse blocky structure, with or without organization into coarse or very coarse prisms. It is firm or very firm and plastic.

The C horizon is massive or has platy structure and is weakly to strongly calcareous silty clay loam to silty clay in most areas.

A leached, slightly acid or neutral C1 horizon, 6 to 18 inches thick, is present in some areas.

Caneadea soils formed in material similar to that of the poorly drained Canadice soils. These soils are on similar landscapes to those of the well drained Arkport soils, the moderately well drained Collamer soils, the somewhat poorly drained Niagara soils, and the moderately well drained Williamson soils. They have a finer textured B horizon than all of these soils. Caneadea soils are near Varysburg soils that formed in gravelly material over clay.

Caneadea silt loam, 0 to 3 percent slopes (CdA).—This soil has a profile similar to the one described as representative for the series, but it is slightly wetter, and the lower part of the subsoil is more acid. This nearly level soil is in flat basins within the valleys of the Oatka and Little Tonawanda Creeks. Individual areas are long and narrow or are oblong. They range from 10 to 30 acres in size.

Included with this soil in mapping were areas of Canadice and Niagara soils. Canadice soils are the poorly drained equivalent of Caneadea soils and are in drainageways and wetter depressional areas. Niagara soils are similar in drainage but contain less clay in the subsoil. Also included in areas adjacent to fans were areas that contain gravelly layers in the substratum.

This Caneadea soil is suited to most crops grown in the county if adequately drained. Undrained areas are better suited to certain grain crops, hay, pasture, or woodland than to other uses. This soil is very plastic when wet and cloddy and hard when dry. Machinery bogs down when the soil is wet. Maintaining soil tilth is a concern of management if this soil is intensively cultivated. Capability unit IIIw–3; woodland suitability group 3w2.

Caneadea silt loam, 3 to 8 percent slopes (CdB).—This gently sloping soil has the profile described as representative for the series. It has convex slopes in areas on hilltops and concave slopes in areas on foot slopes of valleys. Areas on foot slopes receive considerable amounts of runoff from higher areas. These areas are irregular to fan shaped, but the areas on hilltops are roughly circular. Individual areas range from 5 to 30 acres in size.

Included with this soil in mapping were areas of Canadice and Niagara soils. Canadice soils are the poorly drained equivalent of Caneadea soils and are in low depressions and drainageways. Niagara soils are somewhat poorly drained silty soils. Also included were higher areas of soils that have a thin, gravelly surface layer and convex slopes. They are in areas that are adjacent to Varysburg soils.

This Caneadea soil is commonly used for crops used in dairying. It is plastic and sticky when wet and is hard when dry. Maintaining soil tilth is a concern of management. Erosion is a hazard if this soil is cultivated and not protected. Capability unit IIIw–4; woodland suitability group 3w2.

Caneadea silt loam, 8 to 15 percent slopes (CdC).—This soil has a profile similar to the one described as representative for the series, but the subsurface layer generally is thinner. This moderately sloping soil is in convex areas on the sides of valleys. Most areas have a kettle-kame type topography crossed with shallow drainageways that receive runoff from higher areas. On the lower parts of the landscape this soil is somewhat poorly drained, but on higher areas it is moderately well drained. Individual areas are irregular in shape and range from 20 to 30 acres in size.

Included with this soil in mapping were areas of Collamer soils that are more silty and have less clay in the subsoil. Also included were areas of eroded soils that have a silty clay loam surface layer.

This Caneadea soil is suited to most crops commonly grown in the county, but it needs careful management. The surface layer has poor structure, and erosion is a hazard. To assure good germination, cultivating and planting should be done when the soil has the proper moisture content. Additions of organic matter help to maintain good tilth and increase available water capacity. This soil is better suited to a cropping sequence that includes mainly hay or pasture. Capability unit IIIe–8; woodland suitability group 3w3.

Caneadea silty clay loam, 15 to 25 percent slopes, eroded (CeD3).—This soil has a profile similar to the one

described as representative for the series, but most areas that have been cleared and cultivated are eroded to the extent that some of the clayey subsoil material is exposed or turned up by plowing. This moderately steep soil is on sides of the lower valley walls. Many areas are dissected by shallow channels that cannot be crossed with farm machinery. Individual areas are long and are about 50 acres in size.

Included with this soil in mapping were areas of Collamer soils that are silty and have less clay in the subsoil. Also included were areas of silty soils and spots of uneroded soils that were mainly in pastured and wooded areas. A few small areas where till and gravelly material from adjacent higher areas has moved down the slope over the clay deposits were also included.

This Caneadea soil can be used for hay, pasture, or woodland. The hazard of further erosion is serious if the soil is left exposed and unprotected. Capability unit VIe-3; woodland suitability group 3r2.

Caneadea silty clay loam, 25 to 50 percent slopes, eroded (CeE3).—This soil has a profile similar to the one described as representative for the series, but past erosion has exposed a finer textured surface layer. This steep soil is on the sides of valleys and along dissections of lacustrine clay deposits. Individual areas are long and narrow and are about 50 acres in size.

Included with this soil in mapping were areas of silty Collamer and Williamson soils. Also included were a few small areas where till and gravel material from higher adjacent slopes has moved down over the clay deposits.

This steep Caneadea soil is suited mainly to stands of trees or to some other type of permanent cover. Most cleared areas are idle and are severely eroded. Capability unit VIIe-1; woodland suitability group 3r2.

Castile Series

The Castile series is made up of deep, moderately well drained, medium-textured gravelly soils that formed in acid outwash deposits. These soils are nearly level to gently sloping and are on valley terraces and fans in the central and southern parts of the county.

In a representative profile the surface layer is dark grayish-brown gravelly loam 13 inches thick. The upper part of the subsoil is yellowish-brown very gravelly loam. This layer is strongly acid and friable and extends to a depth of 18 inches. Between depths of 18 and 24 inches, the subsoil is friable, brown very gravelly loam that is faintly mottled and strongly acid. Below a depth of 24 inches, the lower part of the subsoil is grayish-brown very gravelly loam. This layer is faintly mottled, very friable, and strongly acid. The substratum, from a depth of 34 inches to 50 inches or more, is medium acid, loose, grayish-brown stratified sand and gravel.

Castile soils have a seasonally high water table in places at a depth of 18 to 24 inches in spring and during excessively wet periods. Rooting depth generally is 24 inches or more. Available water capacity is low. Because of excellent water penetration in the root zone, however, rains during the growing season very effectively increase the moisture supplied to crops rather than being lost through runoff and evaporation. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. Natural fertility is low. Lime needs are moderate to high for some crops.

Representative profile of Castile gravelly loam, 0 to 3 percent slopes, in a cultivated field in the town of Gainesville, one-half mile southeast of the village of Gainesville on Lamont Road, 300 feet east of Lamont Road:

Ap—0 to 13 inches, dark grayish-brown (10YR 4/2) gravelly loam, light brownish gray (10YR 6/2) dry; weak, coarse, granular structure; very friable; many fine roots; 30 to 35 percent gravel; strongly acid; abrupt, smooth boundary.

B21—13 to 18 inches, yellowish-brown (10YR 5/4) very gravelly loam; weak, medium, subangular blocky structure; friable; common fine roots; many pores without clay linings; 40 percent gravel; strongly acid; clear, wavy boundary.

B22—18 to 24 inches, brown (10YR 5/3) very gravelly loam; common, medium, faint, yellowish-brown (10YR 5/4) and gray (10YR 5/1) mottles; very weak, medium, subangular blocky structure; friable; few fine roots; many fine pores; 40 percent gravel; strongly acid; clear, wavy boundary.

B3—24 to 34 inches, grayish-brown (10YR 5/2) very gravelly loam; few, faint, yellowish-brown (10YR 5/4) mottles; massive; very friable to loose; 50 to 60 percent gravel; strongly acid; abrupt, wavy boundary.

IIC—34 to 50 inches, grayish-brown (10YR 5/2) stratified sand and gravel; loose; 60 to 70 percent unweathered gravel; medium acid.

The solum ranges from 24 to 38 inches in thickness. Reaction ranges from strongly acid to very strongly acid to a depth of 30 inches and from strongly acid to slightly acid below that depth. Bedrock is at a depth of 5 to 50 feet or more. Coarse fragments are mainly gravel, but they also include cobblestones and angular fragments. The content of coarse fragments averages more than 35 percent, by volume, between depths of 10 and 40 inches.

The Ap horizon has a hue of 10YR or 2.5Y, a value of 3 to 5, and a chroma of 2 or 3. It ranges from loam to silt loam. The content of coarse fragments ranges from 20 to 50 percent.

The B horizon has a hue of 7.5YR to 2.5Y, a value of 4 or 5, and a chroma of 3 to 6. Mottles of 2 chroma or less are at depths of 15 to 24 inches. This horizon ranges from sandy loam to silt loam. The content of gravel in individual horizons ranges from 20 to 60 percent, by volume.

The C horizon is stratified sand and gravel of various sizes.

Castile soils are associated with gravelly Chenango and Howard soils in adjacent drier areas and with Halsey and Red Hook soils in lower, wetter areas. They are on landscapes similar to those of Phelps and Scio soils. Castile soils are more acid than Phelps soils, and they lack the silty, mostly gravel-free solum of Scio soils to depths of 40 inches or more.

Castile gravelly loam, 0 to 3 percent slopes (CgA).—This soil has the profile described as representative for the series. It is nearly level and is on low outwash stream terraces and lower lying areas in or adjacent to the better drained, gravelly Chenango soils. Individual areas vary in shape and size. They range from 5 to 30 acres or more in size.

Included with this soil in mapping were areas of drier Chenango soils on slightly higher rises. Also included were areas of the wetter, gravelly Halsey and Red Hook soils in slightly lower areas and small areas of gently sloping Castile soils.

This Castile soil can be used quite intensively for a wide variety of crops. Because of the seasonal high water table, this soil is not ready for cultivation as early as the higher and drier associated Chenango soils. Frequent applications of fertilizer are needed for good crop growth. Potatoes are well adapted to this soil, but the content of gravel in the upper layers interferes with mechanical harvesting equipment in places. Capability unit IIw-1; woodland suitability group 3o1.

Castile gravelly loam, 3 to 8 percent slopes (CgB).—This gently sloping, gravelly soil is on low stream terraces that commonly receive runoff from adjacent soils at higher elevation. In places, it also occurs as undulating areas that have a high, basin-controlled water table. The size and shape of individual areas are variable. They range from 5 to 20 acres or more in size.

Included with this soil in mapping were areas of drier Chenango and Howard soils on higher areas. Also included were areas of wetter Halsey and Red Hook soils. These areas are indicated on the soil map by the symbols for wet spots and drainage.

This Castile soil is suited to most crops, and it can be used intensively for row crops. The hazard of erosion is slight if this soil is cultivated and not protected. The seasonally high water table generally is not so limiting for early-season cultivation as on the lesser sloping Castile soils, but seep spots and runoff from adjacent soils are more important limitations. Most crops require frequent applications of fertilizer. Gravel fragments limit some mechanical harvesting operations. Capability unit IIe-4; woodland suitability group 3o1.

Castile channery silt loam, fans, 0 to 3 percent slopes (ChA).—This soil has a profile similar to the one described as representative for the series, but the coarse fragments are flat rather than rounded. Also, this soil generally has a higher content of silt and a lower content of sand. This nearly level soil is on outwash fans that are mainly in the southeastern corner of the county. These fans are in areas where narrow side streams enter a larger valley. This soil is associated mainly with side streams that have low slope gradients as they enter the main valley. In places this soil is at the fan margins along with gently sloping Chenango soils that are near the fan apex along streams that have higher slope gradients. Individual areas are fan or apron shaped and range from 10 to about 50 acres in size.

Included with this soil in mapping were areas of channery Chenango soils, generally near the fan center and areas of a similar soil that has a thin mantle of alluvium, commonly near the fan margin.

This Castile soil is used for nearly all crops commonly grown in the county. Row crops, such as potatoes, grow well because this soil has a higher available water capacity than that of typical Castile soils. Slight wetness delays planting for short periods in places. Some flood damage is possible, and it generally is caused by a tributary stream. The main stream seldom floods this soil. Capability unit IIw-1; woodland suitability group 3o1.

Chenango Series

The Chenango series is made up of deep, acid, well-drained to somewhat excessively drained, medium-textured, gravelly soils that formed in outwash deposits. These deposits are derived mainly from acid sandstone. These soils are level to steep and are on glacial outwash plains, stream terraces, fans, and in rolling to hilly kame-kettle areas. They are extensive in the southern half of the county.

In a representative profile the surface layer is dark grayish-brown gravelly loam 9 inches thick. The upper part of the subsoil is very friable, yellowish-brown very gravelly loam about 19 inches thick. It is strongly acid. The lower part of the subsoil, between depths of 28 and 34 inches, is dark yellowish-brown very gravelly loam that is very friable and strongly acid. The substratum, at a depth of 34 inches and extending to a depth of 60 inches or more, is dark-brown to dark grayish-brown stratified sand and gravel that is very friable or loose and strongly acid.

Chenango soils are used extensively for crops, such as potatoes. The water table generally is below a depth of 40 inches. Rooting depth is unrestricted and commonly is below 30 inches for deep-rooted crops. Available water capacity is low. Droughtiness is a slight hazard in places in drier periods during the growing season. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. Natural fertility is low, and lime needs are high for most crops. These soils dry out rapidly in spring and are ready for tillage early in the growing season. Gravel limits tillage and harvesting operations in places (fig. 15).

Representative profile of Chenango gravelly loam, 3 to 8 percent slopes, in a cultivated field in the town of Gainesville, one-half mile southeast of village of Gainesville on Lamont Road, 100 feet east of Lamont Road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, fine, granular structure; very friable; many roots; 35 percent gravel; medium acid; abrupt, smooth boundary.

B21—9 to 21 inches, yellowish-brown (10YR 5/6) very gravelly loam; weak, fine, granular structure; very friable; common fine roots; many pores; 40 percent gravel; strongly acid; clear, wavy boundary.

B22—21 to 28 inches, yellowish-brown (10YR 5/4) very gravelly loam; weak, fine, granular structure; friable; common fine roots; many pores; 45 percent gravel; strongly acid; clear, wavy boundary.

B3—28 to 34 inches, dark yellowish-brown (10YR 4/4) very gravelly loam; single grain; very friable; few roots;

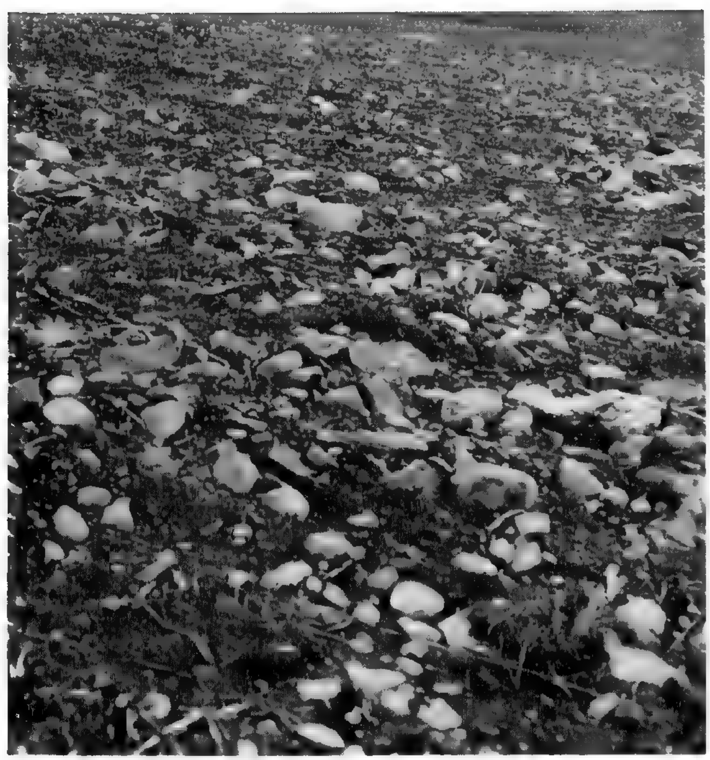

Figure 15.—Gravelly Chenango soil.

many pores; few limestone ghosts; 50 to 60 percent gravel; strongly acid; clear, wavy boundary.

IIC—34 to 60 inches, dark-brown (10YR 4/3) to dark grayish-brown (10YR 4/2) stratified sand and gravel; 15 percent cobblestones more than 4 inches in diameter; massive and single grain; very friable or loose; strongly acid.

The solum ranges from 24 to 36 inches in thickness. Reaction is strongly acid or very strongly acid in unlimed areas. Bedrock is at a depth of 5 to 50 feet or more. Carbonates are at a depth of 8 feet in places. Coarse fragments are mainly gravel but include cobblestones and a few angular rock fragments. The content of coarse fragments in the upper 10 to 40 inches averages more than 35 percent, by volume.

The Ap horizon has a hue of 10YR or 2.5Y, a value of 3 to 5, and a chroma of 2 or 3. This horizon ranges from loam to silt loam. The content of coarse fragments is 5 to 50 percent.

The B horizon has a hue of 7.5YR to 2.5Y, a value of 4 or 5, and a chroma of 3 to 6. A chroma of more than 4 is limited to the upper part. The subhorizons range from sandy loam to silt loam. The content of gravel or channery fragments is 20 to 60 percent, by volume. This horizon has weak granular or subangular blocky structure.

The C horizon is stratified with various sizes of sand and gravel. This horizon becomes less acid as depth increases, but reaction is strongly acid to a depth of 40 inches or more.

Chenango soils are near Bath soils in places, but unlike Bath soils they lack a fragipan. Chenango soils are associated in a drainage sequence with the moderately well drained Castile soils and the somewhat poorly drained Red Hook soils that formed in similar material. They occupy landscapes similar to those occupied by Allard, Howard, Palmyra, and Valois soils. Chenango soils lack the thick silty mantle of Allard soils, are more acid than Howard and Palmyra soils, and have a well-sorted gravelly substratum in contrast to the random sorting in the substratum of Valois soils.

Chenango gravelly loam, 0 to 3 percent slopes (CIA).—This level to nearly level soil is on outwash plains and stream terraces that vary considerably in size and shape. Individual areas are as large as 100 acres.

Included with this soil in mapping were areas of moderately well drained, gravelly Castile soils in slight depressional areas. Also included were areas of silt-mantled Allard soils and clayey substratum Varysburg soils.

This Chenango soil is well suited to most crops and can be used intensively for row crops. Crops, such as peas, that require early season planting grow well. Lack of moisture during dry periods is a slight limitation in places. Because of the large acreage and extensive use for potato production, this soil is important to the farming economy of the county. Available water capacity is slightly better than that of the more sloping Chenango soils. Natural fertility is low, and fertilizer needs are high. Large amounts of lime are needed for some crops. Gravel seriously limits use of mechanical potato harvesting equipment in places. Capability unit IIs–1; woodland suitability group 3o1.

Chenango gravelly loam, 3 to 8 percent slopes (CIB). This gently sloping soil has the profile described as representative for the series. Areas vary in shape, and some individual areas are as large as 60 acres or more. In places this soil receives runoff from higher adjacent soils.

Included with this soil in mapping were areas of moderately well drained Castile soils in small slight depressional areas. Also included were areas of Bath soils that are underlain, in the deep substratum, by gravelly and sandy material; Allard soils that have a mantle of silt; and Varysburg soils that have a clayey substratum.

This Chenango soil is well suited to intensive use for most crops. Potatoes are the main crop. Other crops, such as peas, that require early season planting are well suited to this soil. Lack of moisture and the hazard of erosion are slight limitations. Available water capacity generally is not so high as that of nearly level Chenango soils. Fertilizer needs are high. Coarse gravel interferes with potato harvesting equipment in places. Capability unit IIs–2; woodland suitability group 3o1.

Chenango gravelly loam, 8 to 15 percent slopes (CIC).—This soil has a profile similar to that described as representative for the series, except that the subsurface layer is thinner in places. This moderately sloping soil is along valley sides and in the kame-kettle areas that are associated with lateral and terminal moraines. In the kame-kettle areas, slopes are short and complex, and the soil receives no runoff from adjacent soils. In other areas, slopes tend to be longer and in one direction, and in places the soil receives runoff from adjacent soils. Individual areas are as large as 50 acres or more in places.

Included with this soil in mapping were areas of Bath soils underlain by gravel, especially in the kame-kettle areas. Also included were a few areas of wetter, gravelly outwash soils on foot slopes and in potholes in the kame-kettle areas. These areas commonly are indicated on the soil map by the symbols for drainageway and wet spot. Areas of Varysburg soils were also included, especially near Portageville.

This soil is suited to crops commonly grown in the county. The hazard of erosion is slight to moderate, even though this soil is moderately sloping. The content of pebbles in the surface layer and the high rate of infiltration cause the amount of runoff to be small. The short, irregular slopes in the kame-kettle area limit some tillage and harvesting operations in places. Available water capacity is slightly lower than that in Chenango soils on lesser slopes. Capability unit IIIe–1; woodland suitability group 3o1.

Chenango gravelly loam, 15 to 25 percent slopes (CID).—This moderately steep soil has a profile similar to the one described as representative for the series, but the surface layer and the upper part of the subsoil generally are thinner. This soil is on the sides of outwash terraces and in kame-kettle areas. Slopes in the kame areas are short and complex, and the soil receives no runoff from adjacent soils. Other areas receive runoff from upper adjacent soils in places. Individual areas range from 8 to 30 acres or more in size.

Included with this soil in mapping were spots of wetter Halsey and Red Hook soils in potholes in the kame-kettle areas. Also included were areas of Bath soils that are underlain by a gravelly substratum.

This soil is better suited to hay, pasture, and woodland than to other uses. Steepness limits the use of this soil for farming. This soil is droughty. Erosion and the danger of damage to equipment and injury to equipment operators are severe hazards because of slope. Moderate amounts of fertilizer and lime are needed for good hay and pasture growth. Capability unit IVe–1; woodland suitability group 3r1.

Chenango channery silt loam, fans, 3 to 8 percent slopes (CmB).—This gently sloping soil has a profile similar to the one described as representative for the series, but the coarse fragments are flat rather than rounded as are those in a stream terrace. Also, this soil has a higher content of silt and a lower content of sand. This soil is on fans that are mainly in the southeastern part of the county.

These fans are in outlet areas where narrow side streams that have a high slope gradient enter the main valley. This soil occupies the entire fan or is on the fan along with nearly level, channery Castile soils that are moderately well drained. In these areas this soil is near the fan apex, and the Castile soil is at the fan margins. Individual areas are about 30 to 50 acres in size.

Included with this soil in mapping were some small spots of Castile soils near the fan margins.

This soil is suited to most crops commonly grown in the county. Row crops, such as potatoes, grow well. Lack of moisture is a slight limitation in places. The hazard of erosion is slight. Stones limit use of harvesting equipment. Some flood damage from the tributary stream occurs rarely. The main stream generally does not back up onto any but the lowest areas of this soil and then only where it merges with a soil that formed in alluvium rather than the Castile soil. Capability unit IIs-2; woodland suitability group 3o1.

Churchville Series

The Churchville series is made up of gently sloping to moderately sloping, deep, somewhat poorly drained soils that formed in contrasting deposits. The surface deposit, ranging from 20 to 36 inches in thickness, is lacustrine silt and clay. It mantles channery or gravelly, medium-textured glacial till. These soils are on the upper side slopes of several of the main valleys. The largest area is above the valley of the Genesee River.

In a representative profile the surface layer is very dark grayish-brown silt loam 8 inches thick. The subsurface layer is mottled, light brownish-gray, friable silt loam that interfingers around blocks of the upper part of the subsoil at a depth of about 11 inches. The upper part of the subsoil is mottled, dark grayish-brown, firm silty clay loam about 7 inches thick. The surface layer, subsurface layer, and the upper part of the subsoil are slightly acid. The lower part of the subsoil, extending from a depth of 18 to 30 inches, is mottled, olive-brown silty clay that is firm and neutral. The soil is mainly free of stones at these depths. The substratum, which is at a depth of 30 inches and extends to a depth of more than 45 inches, is mottled, olive-brown, firm channery loam till. This layer contains a moderate amount of stone fragments and is calcareous.

Churchville soils have a medium to high ability to supply nutrients. Potash reserves are high. Available water capacity is moderate. Permeability is moderate in the surface layer, moderately slow or slow in the lower part of the subsoil, and slow in the substratum. A temporary high water table is at a depth of 6 to 18 inches in places during wet periods. Bedrock is at a depth of 40 inches to 8 feet in some areas, especially near Letchworth Park.

Representative profile of Churchville silt loam, 2 to 8 percent slopes, in a cultivated field in the town of Castile, one-half mile east of intersection of DeGolyer Road and County Road No. 6, 2 miles east of the village of Castile:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish-gray (10YR 6/2) dry; moderate, medium, granular structure; friable; many fine roots; slightly acid; abrupt, smooth boundary.

A2—8 to 11 inches, light brownish-gray (10YR 6/2) silt loam; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; many fine roots; common fine pores; slightly acid; clear, irregular boundary.

B&A—11 to 18 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam; many, medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; common fine roots; few pores; thin fingers of light brownish-gray (10YR 6/2) silt coats surrounding peds in the upper part; slightly acid; gradual, wavy boundary.

B2t—18 to 30 inches, olive-brown (2.5Y 4/4) silty clay; many, medium, distinct, olive-gray (5Y 5/2) and yellowish-brown (10YR 5/6) mottles; moderate, coarse, angular blocks in coarse prismatic structure; firm; dark grayish-brown (10YR 4/2) ped coats; few roots along prism faces; few fine pores; continuous dark-gray (10YR 4/1) clay coats on ped faces; few pebbles in lower part; neutral; abrupt to clear, wavy boundary.

IIC—30 to 45 inches, olive-brown (2.5Y 4/4) channery loam; many, medium, distinct, light-gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; moderate, very thick, platy structure; firm in place, friable when crushed; few fine pores with clay linings; 25 percent coarse fragments; calcareous; moderately alkaline.

The solum ranges from 20 to 36 inches in thickness and corresponds to the depth to the IIC horizon. Bedrock is at a depth of more than 40 inches. The content of coarse fragments ranges from 0 to 5 percent in the solum and from 15 to 35 percent in the IIC horizon. The solum has a hue of 2.5Y to 5YR. Reaction ranges from medium acid to neutral in the surface horizons, from neutral to mildly alkaline in the B2t horizon, and is moderately alkaline in the IIC horizon, which generally is calcareous.

The Ap horizon has a value of 3 to 5 when moist, a value of 6 or 7 when dry, and a chroma of 2 or 3.

The A2 horizon, if present, has a value of 4 to 6 and a chroma of 2 to 4. This horizon has common to many mottles. It ranges from loam or silt loam to silty clay loam. This horizon has weak or moderate granular or blocky structure.

The B horizon has ped coats that have a chroma of 1 or 2 and ped interiors that have a value of 4 or 5 and a chroma of 2 to 4. This horizon has distinct mottling. It ranges from clay loam to clay in texture and is 35 to 55 percent clay. This horizon has moderate to strong blocky structure within prisms. Clay films on ped faces range from patchy to continuous.

The IIC horizon is loam or silt loam. Mottles in this horizon are faint to distinct.

Churchville soils commonly are near Caneadea and Erie soils on similar landscapes. These soils formed in thinner clayey deposits over till than similar Caneadea soils. They have a finer textured B horizon than Erie soils and lack the fragipan and channery fragments in the solum that are characteristic of Erie soils. Churchville soils are similar to the Dalton soils that formed in silty deposits over till. They lack the fragipan of Dalton soils.

Churchville silt loam, 2 to 8 percent slopes (CnB).—This gently sloping soil has the profile described as representative for the series. It is in thin, clay-mantled parts of the glacial till uplands. It generally has long, single-direction slopes, and it receives runoff from higher adjacent glacial till soils. Most areas are long and moderately wide. One area just north of Letchworth Park is several hundred acres in size.

Included with this soil in mapping were areas of Caneadea soils that have a till substratum at a depth of about 3½ to 5 feet and areas of Erie soils that are dissected by many drainageways about 200 to 300 feet apart. The spots of Caneadea soils commonly are about midway between each drainageway in the thickest part of the clay deposits, while areas of Erie soils commonly are in the drainageways where most of the clay mantle had been washed away. Also included in some places were areas where the surface deposits contain slightly less clay and more silt than those of the representative Churchville soil.

These inclusions make up about 35 percent of the areas of this soil.

This Churchville soil is suited to crops, pasture, or woodland. Crops used in dairying are commonly grown. Unless drained, the choice of crops is limited and tillage is delayed. Good tilth is difficult to maintain because the texture of the surface layer is silt loam that is high in clay content. Erosion is a hazard if this soil is cultivated and not protected. Capability unit IIIw-4; woodland suitability group 3w2.

Churchville silt loam, 8 to 15 percent slopes (CnC).—This moderately sloping soil has a profile similar to the one described as representative for the series, but the surface layer and the upper part of the subsoil generally are thinner. This soil is about halfway between the valley floor and the top of the plateau. It usually is associated with higher, gently sloping Churchville soils and lower, steeper soils on shallow till or glacial lateral moraine deposits. This soil is only in a few areas, and they generally are long bands 50 to 150 acres in size.

Included with this soil in mapping were spots of eroded soils in about one-third of the areas. In these areas the surface layer is silty clay loam that is lumpy when dry and sticky when wet instead of silt loam. Also included were areas of Caneadea and Erie soils.

This Churchville soil is suited to crops, pasture, or woodland. The hazard of erosion is moderate to severe if this soil is cultivated and not protected. Unless this soil is drained, the choice of crops is limited, and planting is delayed. Good tilth is difficult to maintain because of the adverse texture of the surface layer. Crops used in dairying are grown. A large part of this soil is in Letchworth Park where it is idle, used for wildlife habitat, or used for recreational purposes. Capability unit IIIe-8; woodland suitability group 3w3.

Collamer Series

The Collamer series is made up of gently sloping to moderately steep, deep, moderately well drained, medium-textured, medium-lime soils that formed in glacial lake deposits. These deposits are dominantly silt but include layers of very fine sand. These soils are mainly in the west-central part of the county. A few scattered areas are in the Genessee Valley region. They generally are in valley areas and along valley side walls.

In a representative profile the surface layer is dark grayish-brown silt loam 8 inches thick. The subsurface layer is pale-brown, firm silt loam about 2 inches thick that contains some faint mottles. Between depths of 10 and 14 inches, this subsurface layer merges with the upper part of the subsoil. Below a depth of 14 inches, the subsoil is dark yellowish-brown, firm heavy silt loam that has some distinct mottles. This layer is 5 inches thick. The surface and subsurface layers are at the upper part of the subsoil and are slightly acid. Between depths of 19 and 36 inches, the lower part of the subsoil is brown to dark-brown heavy silt loam. It has some distinct mottles and is neutral. The substratum, from a depth of 36 inches down to 60 inches or more, consists of layers of grayish-brown silt and very fine sand with thin layers of clay. The substratum contains some mottles and is calcareous.

The Collamer soils have a seasonal water table that is within 18 inches of the surface early in spring and during long rainy periods. Available water capacity is moderate to high. Permeability is moderately slow in the subsoil. The natural supply of phosphorus and potassium is medium. Lime needs are medium to low.

Representative profile of Collamer silt loam, 8 to 15 percent slopes, in a cultivated field in the town of Sheldon on Almeter Road, 1 mile east of State Route 98:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many fine roots; slightly acid; abrupt, smooth boundary.

A2—8 to 10 inches, pale-brown (10YR 6/3) silt loam; common, medium and fine, faint, yellowish-brown (10YR 5/4 and 5/6) and dark yellowish-brown (10YR 4/4) mottles; weak, thin, platy structure; firm; many fine roots; many fine pores; slightly acid; clear, wavy boundary.

A&B—10 to 14 inches, pale-brown (10YR 6/3) silt loam; weak, medium, subangular blocky structure; firm; common fine roots; many fine pores; slightly acid; clear, wavy boundary.

B21t—14 to 19 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; common, medium and fine, distinct, yellowish-brown (10YR 5/6) and few, fine, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; common fine roots; common fine pores with clay linings; pale-brown (10YR 6/3) silt coats on vertical ped faces; slightly acid; clear, wavy boundary.

B22t—19 to 36 inches, brown to dark-brown (10YR 4/3) heavy silt loam; common, medium and fine, distinct, yellowish-brown (10YR 5/4), strong-brown (7.5YR 5/6), and pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; firm; few roots; common fine pores; distinct clay films in pores and on most ped faces; neutral; clear, wavy boundary.

C—36 to 60 inches, grayish-brown (10YR 5/2) silt and very fine sand layers with thin varves of clay; common, coarse, yellowish-brown (10YR 5/4) mottles in matrix; moderate, medium, platy structure; firm; calcareous; moderately alkaline.

The solum ranges from 30 to 40 inches in thickness. Carbonates are at a depth of 20 to 50 inches. The solum ranges from medium acid to slightly acid in the surface horizons and is neutral in the lower part. Bedrock is at a depth of more than 45 inches and generally is at a depth of more than 10 feet. Few or no coarse fragments are in the solum.

The Ap horizon has a hue of 10YR or 7.5YR, a value of 4 or 5, and a chroma of 2 or 3.

The A2 horizon has a hue similar to that of the Ap horizon, a value of 5 or 6, and a chroma of 2 to 4. This horizon ranges from very fine sandy loam to silt loam in texture. Higher chroma mottles are few to common.

The A&B horizon is 20 to 40 percent B horizon material in a matrix similar to that of the A2 horizon.

The Bt horizon has a hue of 2.5Y to 7.5YR, a value of 4 or 5, and a chroma of 3 or 4. Chromas are 1 or 2 higher in mottles than in the matrix. This horizon ranges from silt loam to light silty clay loam. It has moderate, medium to coarse, subangular blocky structure.

The C horizon is commonly stratified with silt, very fine sand, and varves of clay.

Collamer soils are commonly intermingled with Arkport, Caneadea, Niagara, Varysburg, and Williamson soils. They are finer textured than well-drained Arkport soils and have a coarser textured B horizon than Caneadea soils. The Collamer soils are similar to Niagara soils but are drier. They lack the gravelly material underlain by clay within a depth of 40 inches that is characteristic of Varysburg soils. The Collamer soils are less acid and lack the fragipan of the Williamson soils.

Collamer silt loam, 3 to 8 percent slopes (CoB).—This gently sloping soil has a profile similar to the one described as representative for the series, except that in

places the surface layer is thicker and contains more organic matter. Individual areas are irregular in shape and range from about 5 to 50 acres in size.

Included with this soil in mapping were spots of wetter Niagara soils, finer textured Caneadea soils, more acid Williamson soils, and Varysburg soils that are gravelly and underlain by clay. Also included were small wet areas along drainageways, wet spots, and small eroded areas.

Most areas of this Collamer soil are used for dairy and grain farming. This soil is very erodible, and erosion-control measures are needed in areas that are intensively cultivated. Random drainage is needed on wet spots in places. This soil is free of stones and easy to cultivate. It responds well to good management and is one of the better soils in the county for crops. Capability unit IIe-5; woodland suitability group 2o1.

Collamer silt loam, 8 to 15 percent slopes (CoC).—This moderately sloping or rolling soil has the profile described as representative for the series. It has mostly irregular slopes. It is associated with other lacustrine or outwash soils in or near terminal and lateral moraines along the major valleys in the county. This soil receives little or no runoff from adjacent areas, but it is commonly dissected by small drainageways. Individual areas are irregular in shape or roughly oblong, and range from about 5 to 50 acres in size.

Included with this soil in mapping were small areas of Arkport, Caneadea, Varysburg, and Williamson soils. Also included were small drainageways, wet spots, and eroded areas.

Most areas of this soil are used for hay and grain crops. This soil generally is free of stones and is easy to cultivate. Because of the serious hazard of erosion, the growing of clean cultivated crops should be kept to a minimum. Capability unit IIIe-6; woodland suitability group 2r2.

Collamer silt loam, 15 to 25 percent slopes (CoD).—This soil has a profile similar to the one described as representative for the series, but in places the surface layer is thinner and contains less organic matter. This soil is moderately steep and has mostly short, irregular, hilly slopes. It is associated with other lacustrine or outwash soils in or near terminal or lateral moraines along the major valleys in the county. This soil receives little or no runoff from adjacent areas. Most areas of this soil are dissected by narrow drainageways. Individual units are irregular in shape or roughly oblong and range from 5 to 50 acres in size.

Included with this soil in mapping were spots of eroded soils that make up about one-third of the areas. Also included were areas of more acid Williamson soils, finer textured Caneadea soils, and similar, but drier, soils that lack mottles in the subsoil. Wet spots and areas along drainageways were also included.

This soil is suited to only limited cultivation, pasture, or woodland because of steepness and the very serious hazard of erosion if the soil does not have a protective cover. Most areas of this soil are in pasture or woods. Capability unit IVe-5; woodland suitability group 2r1.

Conesus Series

The Conesus series is made up of deep, moderately well drained, medium-textured soils that formed in calcareous glacial till. The till is derived mainly from mixed limestone, shale, and sandstone. These soils are nearly level to moderately sloping and have convex slopes. The areas are in the northeastern part of the county.

In a representative profile the surface layer is dark grayish-brown gravelly silt loam about 9 inches thick. This is underlain by a thin, leached layer of medium acid, pale-brown loam, about 5 inches thick, that filters into the upper part of the subsoil at a depth of about 14 inches. This leached material surrounds blocks of brown to dark-brown loam to a depth of about 20 inches. From a depth of 20 to 25 inches, the subsoil is friable, brown to dark-brown loam that contains common, distinct mottles. The lower part of the subsoil, from a depth of 25 to 36 inches, is dark-brown, firm gravelly heavy silt loam that is mottled and higher in clay content than the horizons above and below. This layer is slightly acid to neutral. The calcareous till substratum is at a depth of about 36 inches. It consists of firm, grayish-brown gravelly loam that is faintly mottled and that extends to a depth of 50 inches or more.

Conesus soils are wet for brief but significant periods early in spring and after prolonged wet periods. The rooting depth is mainly 25 inches, but a few roots extend deeper in places as the water table recedes in the drier periods in summer. Available water capacity is moderate to high. Permeability is moderate in the upper part of the soil and slow or very slow in the substratum. These soils are medium in their ability to supply nitrogen and phosphorus. Potassium reserves are high. Lime needs are moderate to low.

Representative profile of Conesus gravelly silt loam, 3 to 8 percent slopes, in a cultivated field 2 miles southwest of the hamlet of Linden on Vernal Road, 1,000 feet north of Vernal Corners:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; weak, medium, granular structure; very friable; many fine roots; 15 percent coarse fragments; slightly acid; abrupt, smooth boundary.

A2—9 to 14 inches, pale-brown (10YR 6/3) light loam; weak, thin, platy structure; friable; common fine roots; many fine pores; 10 percent coarse fragments; medium acid; clear, wavy boundary.

A&B—14 to 20 inches, pale-brown (10YR 6/3) light loam surrounds peds of brown to dark-brown (10YR 4/3) loam; weak to moderate, medium, subangular blocky structure; friable; common fine roots; many fine pores; 10 percent coarse fragments; medium acid; abrupt, wavy boundary.

B21—20 to 25 inches, brown to dark-brown (10YR 4/3) loam; common, medium, distinct, strong-brown (7.5YR 5/6) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; few fine roots; common fine pores; 10 percent coarse fragments; medium acid; clear, wavy boundary.

B22t—25 to 36 inches, dark-brown (10YR 4/3 to 3/3) gravelly heavy silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; firm; common fine pores; thick, patchy, grayish-brown (2.5Y 5/2) clay coats on ped faces and in pores; 20 percent coarse fragments; slightly acid to neutral; gradual, smooth boundary.

C—36 to 50 inches, grayish-brown (2.5Y 5/2) gravelly loam; few, fine, faint, brown (10YR 5/3) mottles; very weak, thick, platy structure; firm; 30 percent coarse fragments; calcareous; moderately alkaline.

The solum ranges from 30 to 42 inches in thickness. Carbonates are at a depth of 30 to 45 inches. Content of coarse fragments ranges from 5 to 20 percent in the solum, and the content of gravel and stones is 20 to 35 percent in the C horizon. The solum ranges from medium acid to slightly acid in the A horizon, and from medium acid to mildly alkaline in the B horizon.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to grayish brown (2.5Y 5/2) in color.

The A2 horizon and the A part of the A&B horizon range from grayish brown (10YR 5/2) to light yellowish brown (2.5Y 6/4). These horizons are loam or silt loam. Mottles are none to common, and they are faint.

The B horizon ranges from brown or dark brown (10YR 4/3 to 10YR 3/3) to olive brown (2.5Y 4/4). Mottles are common or many, fine to medium, and faint or distinct. This horizon ranges from loam or silt loam to light clay loam.

The C horizon ranges from dark grayish brown (10YR 4/2) to pale olive (5Y 6/3) in color. Texture is loam or silt loam.

Conesus soils are associated with the wetter Appleton soils and the better drained Lansing soils that formed in similar material. They are also near Danley and Nunda soils and lack the contrasting silty mantle over till that is characteristic of Nunda soils.

Conesus gravelly silt loam, 0 to 3 percent slopes (CrA).—This nearly level soil has a profile similar to the one described as representative for the series, but the surface layer generally is slightly darker. This soil is on the more level topography near drumlins. Individual areas are irregular in shape and range from about 5 to 50 acres in size.

Included with this soil in mapping were small areas of Nunda soils that have a silty surface layer and a finer textured subsoil and areas of a soil that is similar but higher in lime content. Also included were small spots of better drained Lansing soils on slight rises and knolls. Areas of wetter Appleton soils were included in depressions. Other inclusions were nongravelly areas and wet spots.

This Conesus soil is mostly cleared and used for hay and grain crops in support of dairy operations. Some areas are used for dry beans. Random drainage of included wet spots generally is needed. This soil dries a little slower in spring than the included spots of Lansing soils, and planting is delayed briefly in places. It has the potential to be one of the most productive soils in the county. This Conesus soil responds well to good management. Runoff is slow, and erosion is not a hazard. Capability unit IIw-1; woodland suitability group 2o2.

Conesus gravelly silt loam, 3 to 8 percent slopes (CrB).—This gently sloping soil has the profile described as representative for the series. It generally is just below Lansing soils on the sides of drumlins or in undulating glacial till areas. It receives some runoff from surrounding areas at higher elevation. Individual areas are mostly irregular in shape and range from about 5 to more than 200 acres in size.

Included with this soil in mapping were areas of Nunda soils that are finer textured in the lower part of the subsoil and areas of soils that are similar to this soil but higher in lime content. Also included were small spots of better drained Lansing soils and spots of wetter Appleton soils along drainageways and in depressions.

Most areas of this Conesus soil are cleared and are used for hay and grain crops in support of dairy operations. Many areas are used for dry beans. This is the major soil in the Conesus series, and it is one of the better soils in the county for crops. This soil is a little slower to dry out in spring than the better drained, associated Lansing soil. Random drainage of wet spots is needed in places to increase the efficiency of farming operations. This soil responds well to good management. The hazard of erosion is slight if this soil is cultivated and not protected. Capability unit IIe-4; woodland suitability group 2o2.

Conesus gravelly silt loam, 8 to 15 percent slopes (CrC).—This moderately sloping soil has a profile similar to the one described as representative for the series, except that the surface layer and the upper part of the subsoil are thinner in most places. This soil is on parts of drumlins that receive large amounts of runoff from surrounding areas at higher elevation. It generally is below Lansing soils and above Appleton soils. Individual areas are oblong or thin. They range from about 5 to 50 acres in size.

Included with this soil in mapping were spots of better drained Lansing soils, Nunda soils that have a finer textured subsoil than this soil, and soils that are similar to this soil but higher in lime content. Also included were nongravelly areas, eroded spots, and small, wetter areas.

This Conesus soil is mostly cleared and used for hay and grain crops in support of dairy operations. It is not so desirable for farming as less sloping Conesus soils. Erosion is a greater hazard if this soil is cultivated and not protected. The operation of farm machinery is more difficult on this soil than it is on less sloping Conesus soils. Drainageways are common in this soil because of the runoff from higher adjacent areas. Random drainage of these areas is needed in places. Capability unit IIIe-4; woodland suitability group 2o2.

Dalton Series

The Dalton series is made up of deep, somewhat poorly drained, acid, medium-textured soils that formed in contrasting silty deposits underlain by firm glacial till. These soils are nearly level to gently sloping and are in depressional areas on the upland till areas in the southern half of the county.

In a representative profile the plow layer is very dark grayish-brown silt loam about 8 inches thick. The upper part of the subsurface layer is distinctly mottled, grayish-brown, very strongly acid light silt loam that has no coarse fragments. It extends to a depth of about 15 inches. Between depths of 15 to 18 inches, the subsurface layer is light brownish-gray light silt loam that is prominently mottled. It contains a few coarse fragments. At a depth of about 18 inches is a dense fragipan subsoil that formed in till. It is very firm, mottled, brown to dark-brown channery loam in the upper part. Coarse sandstone fragments are common. Below a depth of about 42 inches, the fragipan is very firm, grayish-brown channery loam that has a few mottles. This layer is medium acid and contains more stone fragments than the layer above. The substratum, from a depth of 56 to 70 inches or more, is very firm, grayish-brown channery loam that is slightly acid in the upper part and neutral below.

Dalton soils have a seasonally high water table near the surface in spring and during wet periods. A dense, very firm fragipan below the upper silt mantle restricts the downward movement of water. Rooting depth generally is 18 inches. Available water capacity is moderate. Permeability is moderate above the dense fragipan and slow and very slow in the fragipan and substratum. Natural fertility is medium to low, and lime needs are high. If drainage facilities are properly installed, these soils can be used for row crops.

Representative profile of Dalton silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Pike, 30 feet north of Safford Road and 400 feet west of State Route 19:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, coarse, granular structure; very friable; many fine roots; strongly acid; abrupt, smooth boundary.

A21—8 to 15 inches, grayish-brown (10YR 5/2) light silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; very weak, medium, subangular blocky structure; friable; common fine roots; common fine pores; very strongly acid; clear, wavy boundary.

A22—15 to 18 inches, light-brownish-gray (2.5Y 6/2) light silt loam; many, medium, distinct, olive-brown (2.5Y 4/4) and prominent strong-brown (7.5YR 5/6) mottles; weak, thin, platy structure; firm; few fine roots; many spherical and vertical cylindrical pores that have olive-brown (2.5Y 4/4) walls; few coarse fragments; very strongly acid; abrupt, irregular boundary.

IIBx1—18 to 42 inches, brown (10YR 4/3) channery loam; strong, very coarse prisms, 8 to 18 inches wide, separated by V-shaped tongues of light brownish-gray (2.5Y 6/2) silt similar to those in the A22 horizon; tongues are 1 inch wide at the top and taper to silty films below a depth of 27 inches; outer 3/8 inch of prism is strong brown (7.5YR 5/8) and interiors have common, thread-like, grayish-brown (2.5Y 5/2) mottles; very firm and brittle; common fine pores that have thin clay linings; 20 percent coarse fragments; medium acid; gradual, wavy boundary.

IIBx2—42 to 56 inches, grayish-brown (2.5Y 5/2) channery loam; few, fine and medium, distinct, yellowish-brown (10YR 5/4) mottles; massive; very firm and brittle; common fine pores that have gray (10YR 5/1) clay linings; 30 percent coarse fragments; medium acid; gradual, wavy boundary.

IIC—56 to 70 inches, grayish-brown (2.5Y 5/2) channery loam; moderate, medium, lens-shaped plates that have gray (10YR 5/1) edges; very firm; few fine pores; 30 percent coarse fragments; slightly acid at a depth of 60 inches, neutral at a depth of 70 inches.

The solum ranges from 40 to 60 inches in thickness. Bedrock is at a depth of 40 inches to more than 20 feet. The silty mantle ranges from 15 to 36 inches in thickness.

The Ap horizon has a hue of 2.5Y or 10YR, a value of 3 or 4, and a chroma of 2. Reaction ranges from neutral to strongly acid, depending upon the amount of lime that has been applied.

The A2 horizon has a hue of 2.5Y to 7.5YR, a value of 5 or 6, and, commonly, a chroma of 2 or less. This horizon contains common to many, fine to coarse, distinct to prominent mottles that have a higher chroma than that of the matrix. It is very fine sandy loam to silt loam. Consistence is very friable to firm. Content of coarse fragments ranges from few to about 15 percent, by volume. The largest amounts are in profiles that have the thinnest silt mantle. This horizon is very strongly acid to slightly acid.

The Bx horizon formed entirely in glacial till where the silt mantle is less than 24 inches thick. Where the mantle is thicker, 3 to 12 inches of the Bx horizon is in the silty mantle. The IIBx horizon has a hue of 5Y to 10YR, a value of 4 or 5, and a chroma of 2 or 3. This horizon is loam or silt loam. It has moderate or strong, very coarse, prismatic structure or is massive. Content of coarse fragments ranges from 20 to 40 percent, by volume. It ranges from strongly acid to slightly acid in the upper part and from medium acid to neutral in the lower part.

Dalton soils are commonly associated with similar Canaseraga soils that are in drier, adjacent areas. Dalton soils are similar to the Erie, Volusia, and Wallington soils on similar landscapes. They have a contrasting silty mantle, 15 to 36 inches thick, over till that is lacking in Erie and Volusia soils. Dalton soils have a thinner silty mantle than that of Wallington soils, which formed entirely in silty deposits.

Dalton silt loam, 0 to 3 percent slopes (DaA).—This nearly level soil is on concave or flat uplands where runoff is slow or in areas that receive considerable amounts of runoff from higher adjacent soils. Individual areas are very irregular in shape or are circular. They range from 20 to 50 acres in size.

Included with this soil in mapping were areas of Erie, Sun, Volusia, and Wallington soils. The small areas of wetter Sun soils are in depressional areas along drainageways. The spots of similar Erie and Volusia soils are in areas where the silt mantle is less than 15 inches thick, and the areas of Wallington soils are in areas where the silt mantle was more than 36 inches thick. Also included were areas of soils that have stratified silt and till in the substratum.

This Dalton soil is used for crops, including corn, small grain, and hay. Adequate drainage is needed for good crop response and access early in spring. Undrained areas are better suited to hay, pasture, and woodland than to other uses. Capability unit IIIw–2; woodland suitability group 3w5.

Dalton silt loam, 3 to 8 percent slopes (DaB).—This soil has the profile described as representative for the series. It is gently sloping and is in long, broad, concave areas that receive runoff from higher adjacent soils. Individual areas are oblong or circular. They range from 10 to 40 acres in size.

Included with this soil in mapping were a few areas of moderately sloping soils. Also included were similar, but better drained, Canaseraga soils on knolls and rises. Wetter areas are indicated on the soil map by the symbols for wet spots and drainageways. Also included were areas of soils that have a substratum of stratified silt underlying the till.

This Dalton soil is used for most general crops, including corn, small grain, hay, pasture, and woodlots. Unless this soil is drained, wetness limits suitability for some kinds of crops and delays planting in spring. Adequately drained areas are occasionally used for potatoes. The hazard of erosion is serious if this soil is cultivated and not protected. Capability unit IIIw–6; woodland suitability group 3w5.

Danley Series

The Danley series is made up of deep, moderately well drained soils that have a moderately fine textured subsoil. These soils formed in calcareous shaly glacial till. They are gently sloping to steep and are in upland till areas in the north-central and northeastern parts of the county.

In a representative profile, in a cultivated area, the surface layer is very dark grayish-brown silt loam about 9 inches thick. It contains a few shale fragments. The subsurface layer is friable, brown silt loam, about 3 inches thick, and it contains a few faint mottles and a few shale fragments. The subsoil, at a depth of 12 inches, is firm, olive-brown shaly clay loam in the upper part. This part of the subsoil has common faint mottles. Reaction is slightly acid. The lower part of the subsoil, from a depth of 22 to 36 inches, is firm, dark grayish-brown to olive-brown shaly silty clay loam that has common yellowish-brown mottles. The substratum is calcareous, olive-gray shaly silty clay loam till. It is firm and is faintly mottled to a depth of 50 inches or more.

Danley soils have a seasonal high water table in places at a depth of 18 to 24 inches in spring and during wet periods. The rooting depth is mainly 24 inches. Available water

capacity is moderate. Permeability is moderate in the surface layer and subsurface layer, moderately slow in the subsoil, and slow or very slow in the substratum.

Representative profile of Danley silt loam, 3 to 8 percent slopes, in a cultivated area in the town of Covington, on Van Allen Road near its junction with Lamb Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate, medium, granular structure; friable; many fine roots; 10 percent shale fragments; medium acid; abrupt, smooth boundary.

A2—9 to 12 inches, brown (10YR 5/3) silt loam; few, fine, faint, light olive-brown (2.5Y 5/4) mottles; weak, medium and fine, subangular blocky structure breaking to weak, thin, platy; friable; many fine roots; many fine and medium pores; 10 percent shale fragments; medium acid; clear, wavy boundary.

B21t—12 to 22 inches, olive-brown (2.5YR 4/4) shaly clay loam; ped faces have brown (10YR 5/3) silt coats in upper 4 inches; common, fine, faint, dark grayish-brown (10YR 4/2) and few, medium, faint, light olive-brown (2.5YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; few to many fine roots; common fine pores; 10 percent of vertical ped faces have dark grayish-brown (2.5Y 4/2) clay coats; 20 percent soft shale fragments; slightly acid; diffuse boundary.

B22t—22 to 36 inches, dark grayish-brown (2.5Y 4/2) shaly silty clay loam; common, fine and medium, yellowish-brown (10YR 5/4) mottles; moderate, medium and coarse, subangular blocky structure; firm; few roots; common fine pores that have thick clay linings; clay coats in depressions on ped faces; 20 percent shale fragments; slightly acid; gradual boundary.

C—36 to 50 inches, olive-gray (5Y 4/2) shaly silty clay loam; common, medium, faint, olive-brown (2.5Y 4/4) mottles; crude, thick, lenticular, platy structure; firm; few discontinuous clay films on ped faces in upper part; 25 to 30 percent shale fragments; calcareous; moderately alkaline.

The solum ranges from 36 to 45 inches in thickness. Carbonates are at a depth of 30 to 60 inches. The upper part of the solum ranges from strongly acid to slightly acid in reaction and becomes less acid with depth. Bedrock is mainly gray to black calcareous shale of variable hardness. It is at a depth of 40 inches to 10 feet or more. The content of coarse fragments in the upper part of the solum ranges from 0 to 15 percent, by volume, and increases with depth to 25 percent in the lower part of the solum.

The Ap horizon has a hue of 2.5Y or 10YR, a value of 3 to 5, and a chroma mainly of 2. This horizon ranges from loam to light silty clay loam.

The A2 horizon is similar in hue to the Ap horizon. It has a value of 4 to 6 and a chroma of 3 or 4. It has none to common faint mottles. Texture is silt loam or light silty clay loam. The A2 horizon is absent in places in deeply plowed areas.

The B2t horizon has a hue of 5Y to 10YR, a value of 4 or 5, and a chroma mainly of 3. The chroma decreases to 2 in the lower part of many profiles. Mottles have both high and low chroma and are common and distinct or faint. This horizon is mainly silty clay loam. It has weak to moderate, fine to coarse, subangular blocky structure.

The C horizon ranges from loam to silty clay loam and is 15 to 35 percent shale fragments. It has a hue of 10YR to 5Y, a value of 4 or 5, and a chroma of 2 to 4.

Danley soils are in a drainage sequence with the somewhat poorly drained Darien soils and poorly drained Ilion soils that formed in similar material. They are on the same kinds of landscapes as Aurora, Conesus, Lansing, and Nunda soils. They lack the contact with shale bedrock at a depth of 20 to 40 inches which is characteristic of Aurora soils. Danley soils have a finer-textured B horizon than Conesus and Lansing soils. These soils lack the silty mantle of the Nunda soils.

Danley silt loam, 3 to 8 percent slopes (DeB).—This gently sloping soil has the profile described as representative for the series. It has convex slopes in higher areas of the till landscape. Individual areas are circular or oblong.

Included with this soil in mapping were areas of wetter Darien soils along drainageways and in small depressions. Also included were spots of similar Aurora soils where shale bedrock is at a depth of less than 40 inches. These inclusions make up about 25 percent of the areas.

This Danley soil is well suited to crops that support dairying and to pasture or woodland. Random drainage of the included wetter areas is needed if this soil is to be used intensively for crops. Erosion is a hazard if this soil is cultivated and not protected. This soil remains wet for brief but significant periods in spring and after heavy rain. Capability unit IIe-5; woodland suitabilty group 2o2.

Danley silt loam, 8 to 15 percent slopes (DeC).—This soil has a profile similar to the one described as representative for the series, but the thin leached subsurface layer is absent in places. This soil is moderately sloping and has convex slopes in areas where some runoff accumulates.

Included with this soil in mapping were spots of Aurora soils where bedrock is within a depth of 40 inches. Also included were some small areas of Nunda soils in areas that have a silt mantle more than 20 inches thick. Also included were spots of similar, but coarser, Conesus soils. These inclusions make up about 20 percent of the areas.

This soil is not well suited to intensive cultivation. Runoff causes a moderate hazard of erosion. If properly managed, this soil can be used for crops. Most areas are used for crops needed for dairying or are in woodlots. Capability unit IIIe-6; woodland suitability group 2o2.

Danley silty clay loam, 15 to 25 percent slopes, eroded (DlD3).—This moderately steep soil has a profile similar to the one described as representative for the series, but it generally is better drained. In many areas erosion has depleted the content of organic matter, and significant amounts of material from the finer textured subsoil have been incorporated into the surface layer. The leached subsurface layer is in the uneroded inclusions, generally in the wooded areas. This soil is commonly in rather narrow strips alongside slopes and surrounding small drainageways.

Included with this soil in mapping were spots of Aurora soils in areas that have bedrock within a depth of 40 inches. Also included were Nunda soils in areas that have shaly soil material and where the silt mantle is more than 20 inches thick. These inclusions make up about 35 percent of the areas.

The soil is suited to pasture and woodland. It is not suited to crops because of the continuing hazard of further erosion. The use of modern machinery is difficult and hazardous. Pasture seedings generally grow well. Capability unit VIe-3; woodland suitability group 3r2.

Danley silty clay loam, 25 to 40 percent slopes, eroded (DlE3).—This steep soil has a profile similar to the one described as representative for the series, but it is better drained and generally is eroded in cleared areas. Erosion has resulted mainly in a lighter colored, finer textured surface layer. This soil is mainly on the sides of valleys from the village of Wyoming to the hamlet of Linden.

Included with this soil in mapping were spots of Aurora soils that are moderately deep over shale. Also included were some small areas of similar soils that are finer textured.

This soil is too steep for the safe use of farm machinery.

Pastures are usually unimproved. Most of the areas are idle or in woodland. Capability unit VIIe-1; woodland suitability group 3r2.

Darien Series

The Darien series is made up of deep, somewhat poorly drained soils that have a moderately fine textured subsoil. These soils formed in glacial till derived mainly from soft calcareous shale. They are nearly level to moderately sloping and are on uplands across the northern part of the county.

In a representative profile the surface layer is very dark grayish-brown silt loam 9 inches thick. The subsurface layer is friable, medium-acid, mottled, grayish-brown silt loam and extends to a depth of about 12 inches. The upper part of the subsoil, about 8 inches thick, is firm, dark grayish-brown light silty clay loam that contains many faint and distinct mottles. The lower part of the subsoil, to a depth of about 35 inches, is firm, dark grayish-brown silty clay loam that contains many distinct mottles. Reaction ranges from slightly acid in the upper part of the subsoil to mildly alkaline in the lower part. The surface and subsurface layers and the subsoil contain a few shale fragments. Below a depth of 35 inches, the substratum is olive-gray shaly silty clay loam till that has some faint mottles. It is firm and calcareous.

Darien soils have a temporary high water table that restricts rooting depth mainly to 15 to 20 inches. Free water generally is in the upper part of the subsoil during seasonally wet periods. Available water capacity is moderate. Permeability is moderate in the upper layers and slow in the subsoil and substratum. These soils are medium in their ability to supply nitrogen and phosphorus. Potassium reserves are high. Lime needs are medium to low.

Representative profile of Darien silt loam, 0 to 3 percent slopes, in a cultivated field in the town of Bennington, on State Route 354, 2 miles east of the village of Bennington Center on the north side of road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish gray (2.5Y 6/2) dry, crushed, and smooth; moderate, medium, granular structure; friable; many fine roots; 10 percent shale fragments; slightly acid; abrupt, smooth boundary.

A2—9 to 12 inches, grayish-brown (2.5Y 5/2) silt loam; many, distinct, medium, light olive-brown (2.5Y 5/6) mottles; weak, fine, subangular blocky structure; friable; common fine roots; many fine pores; 10 percent shale fragments; medium acid; clear, wavy boundary.

B21t—12 to 20 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam; peds in upper part have grayish-brown (2.5Y 5/2) silt coats; many, medium, faint, olive (5Y 4/3) and olive-brown (2.5Y 4/4) and distinct yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; few fine roots; common fine pores; clay-lined pores, patchy clay films on ped faces; 10 percent shale fragments; slightly acid; gradual, wavy boundary.

B22t—20 to 35 inches, dark grayish-brown (2.5Y 4/2) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/4) and olive (5Y 5/6) mottles; moderate, medium, subangular blocks in very weak, coarse, prismatic structure; firm; common pores; continuous clay coats on ped faces; 10 percent shale fragments; neutral to mildly alkaline; clear, wavy boundary.

C—35 to 50 inches, olive-gray (5Y 4/2) shaly silty clay loam; common, medium, faint, light olive-brown (2.5Y 5/4) mottles; weak, thick, platy structure; firm; 20 percent shale fragments; calcareous; moderately alkaline.

The solum ranges from 30 to 40 inches in thickness. Carbonates are at a depth of 25 to 45 inches. Acidity decreases with depth. The upper part of the solum generally is medium acid to slightly acid, and the lower part is slightly acid to mildly alkaline. Bedrock is mainly gray-to-black shale and is at a depth of 40 inches to 10 feet or more. The content of shale fragments ranges from 0 to 15 percent in the upper part of the solum and becomes greater with depth.

The Ap horizon has a hue of 10YR or 2.5Y, a value of 3 or 4 when moist and 6 or 7 when dry, and a chroma generally of 2. This horizon is dominantly silt loam but ranges to light silty clay loam.

The A2 horizon has a hue of 10YR or 2.5Y, a value of 5 or 6, and a chroma of 2. If the chroma is more than 2, distinct mottles are common to many.

The B2t horizon has a hue of 10YR to 5Y, a value of 3 or 4, and a chroma of 2 or 3. The ped faces are coated with a chroma of 1 or 2.

As much as 35 percent of the C horizon is coarse shale fragments. This horizon is massive or has platy structure.

Darien soils are closely associated with moderately well drained Danley and poorly drained Ilion soils that formed in similar material. They are also near and on the same kinds of landscapes as Burdett, Fremont, and Hornell soils. Darien soils lack the silty mantle of Burdett soils, and they are less acid than Fremont and Hornell soils. They have a coarser textured B horizon and lack the contact with shale bedrock within a depth of 20 to 40 inches that is characteristic of Hornell soils.

Darien silt loam, 0 to 3 percent slopes (DnA).—This soil has the profile described as representative for the series. It is nearly level and generally is in higher areas in the northwestern part of the county. It receives little or no runoff, but surface water is removed slowly.

Included with this soil in mapping, in lower adjacent areas, were spots of the wet, poorly drained Ilion soils. Also included were areas of the more acid Fremont and Hornell soils.

This soil is not suited to crops unless artificially drained. Fibrous-rooted legumes grow well on this soil. Controlling excess water is the main concern of management. This soil generally is well suited to pond sites. Capability unit IIIw-1; woodland suitability group 3w1.

Darien silt loam, 3 to 8 percent slopes (DnB).—This soil has a profile similar to the one described as representative for the series, but the surface layer is thinner in places, and the amount of coarse fragments is commonly greater. This soil is gently sloping or undulating and is in areas where runoff is slow or where water accumulates.

Included with this soil in mapping were spots of Ilion soils along drainageways and in wet spots. Also included were areas of similar Burdett, Fremont, and Hornell soils.

This soil is suited to crops used in support of dairying. Row crops can be grown, but included wet areas and drainageways are limitations to use. Adapted legumes grow well. Erosion is a hazard, especially on the longer slopes, if this soil is cultivated and not protected. Capability unit IIIw-5; woodland suitability group 3w1.

Darien silt loam, 8 to 15 percent slopes (DnC).—This moderately sloping soil has a profile similar to the one described as representative for the series, but the upper part of the subsoil is thinner. This soil generally is in concave areas that receive some runoff from adjacent soils. It generally is below drier Manlius or Danley soils on adjacent steeper areas.

Included with this soil in mapping were areas of a similar, but finer textured, soil in the town of Middlebury. Also included were areas of better drained Danley soils in areas that have more rapid runoff.

This soil is suited to crops, pasture, or trees. Seasonal wetness is a limitation, and the hazard of erosion is severe if this soil is cultivated and not protected. Row crops can be grown, but hay crops should be favored in cropping systems. Heavy equipment is difficult to use on this soil. Capability unit IIIe–9; woodland suitability group 3w1.

Ellery Series

The Ellery series is made up of deep, poorly drained, medium-textured soils that formed in mixed glacial till. The lower part of the subsoil in these soils is a dense, firm fragipan that is slightly acid to neutral. These soils are nearly level or slightly concave in areas of the plateau or upland where water drains very slowly. They are throughout the county, except for the extreme northwestern and northeastern parts.

In a representative profile the surface layer is very dark gray silt loam 8 inches thick. The subsurface layer is friable, gray silt loam about 7 inches thick. It has some mottles, and it contains stone fragments. Below a depth of 15 inches, the subsoil is a mottled, dark grayish-brown silt loam fragipan. This very firm, dense layer has light-gray streaks, ½ to 1 inch thick, that have strong-brown borders and that surround 10- to 15-inch prisms. This layer extends to a depth of about 35 inches, and it contains some stone fragments. The fragipan, at a depth of 35 inches, is dark grayish-brown. It has fewer streaks and mottles than the upper part of the subsoil. From a depth of 50 down to 60 inches or more, the substratum is mottled, dark grayish-brown channery silt loam till. It is firm and calcareous.

Ellery soils have a persistent seasonal high water table. Rooting depth is shallow. Available water capacity is low. Permeability is slow to very slow in the subsoil. Nitrogen, phosphorus, and potassium reserves are medium to high, and lime needs are low.

Representative profile of Ellery silt loam in the town of Sheldon, on Perry Road, 1 mile west of Cattaraugus Road:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; very friable; many fine roots; 5 percent gravel and angular rock fragments; neutral; abrupt, smooth boundary.

A2g—8 to 15 inches, gray (10YR 5/1) silt loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) and strong-brown (7.5YR 5/6) mottles; weak, fine, subangular blocky structure in weak thick plates; friable; few roots; common fine pores; 10 percent coarse fragments; slightly acid; clear, wavy boundary.

Bx1g—15 to 35 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, distinct, light-gray (10YR 6/1 and 7/1) and strong-brown (7.5YR 5/6) mottles; weak thick plates in very coarse prismatic structure; extremely firm and brittle; few fine roots between prisms; common fine pores that have clay linings; ½- to 1-inch thick light-gray (10YR 6/1 and 7/1) coatings with strong-brown (7.5YR 5/8) borders surround 10- to 15-inch prisms; few grayish-brown (10YR 5/2) clay films in lower part; 15 percent coarse fragments; slightly acid; gradual, smooth boundary.

Bx2g—35 to 50 inches, dark grayish-brown (2.5Y 4/2) silt loam; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, very thick, platy structure; very firm and brittle; common fine pores that have clay linings; 15 percent coarse fragments; neutral; diffuse, irregular boundary.

CG—50 to 60 inches, dark grayish-brown (2.5Y 4/2) channery silt loam; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, thick, platy structure; very firm; 20 percent coarse fragments; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Bedrock is at a depth of 40 inches to more than 20 feet. Carbonates are at a depth of 40 to 80 inches. The content of coarse fragments ranges from 5 to 30 percent. These fragments are of mixed angular, flat, and rounded shapes. Total thickness of the A horizon above the fragipan ranges from 10 to 18 inches, and those that are thicker than 15 inches are partly in deposits of local alluvium.

The A1 horizon, if present, ranges from 4 to 9 inches in thickness. If this horizon is more than 6 inches thick, it has a thin mantle of local alluvium. The A1 or Ap horizon has a hue of 2.5Y or 10YR, a value of 2 or 3, and a chroma of 1 or 2. It ranges from loam to silt loam in texture. Reaction ranges from neutral to medium acid.

The A2g horizon has a hue of 10YR to 2.5Y, a value of 4 to 6, and a chroma of 1 or 2. Mottles are distinct, and they range from few to common. They have a higher chroma than that of the matrix.

The Bx horizon has a hue of 5Y to 10YR, a value of 4 or 5, and a chroma dominantly of 1 or 2. Mottles are few to common and faint to distinct. Texture is loam or silt loam.

The C horizon has a hue of 10YR to 5Y, a value of 4 or 5, and a chroma of 1 or 2. This horizon is loam or silt loam. It is massive or has weak or moderate, medium to very thick, platy structure. Consistence is firm or very firm, and reaction ranges from neutral to strongly calcareous.

Ellery soils are closely associated with similar, but somewhat poorly drained, Erie soils. They are in topographic positions similar to those of the Alden, Lyons, and Sun soils; but Ellery soils differ from these soils in having a fragipan.

Ellery silt loam (Ee).—This is the only Ellery soil mapped in the county. It is nearly level or slightly concave and is in upland till areas that receive considerable amounts of runoff from adjacent, drier soils. Individual areas are in small irregular pockets or long narrow strips along drainageways. The areas generally average 10 to 20 acres in size, but areas as large as 100 acres are common.

Included with this soil in mapping were areas of the better drained Erie and Volusia soils on knolls. Also included were small areas of similar Ilion and Lyons soils in the northern part of the county and wetter areas of finer-textured Alden soils. The wet areas are indicated on the soil map by the symbol for a wet spot. In places, wet pockets were included within the kettlekame topography. In these pockets the fragipan is not so firm and dense as that of the representative Ellery soil.

This Ellery soil can be used only for pasture and woodland unless properly drained. If adequately drained and properly managed, selected crops can be grown. These areas are well suited to pond sites and as wildlife marshes. Capability unit IVw–2; woodland suitability group 4w2.

Erie Series

The Erie series is made up of deep, somewhat poorly drained, medium-textured soils. These soils have a strongly expressed fragipan at a depth of about 10 to 16 inches. They formed in mixed glacial till. The fragipan is slightly acid to neutral. This soil is nearly level to moderately sloping and is on uplands in all but the extreme northern part of the county.

In a representative profile the surface layer is very dark grayish-brown channery silt loam about 8 inches thick. The subsurface layer is medium acid, friable, pale-brown and light brownish-gray channery silt loam that has many distinct mottles. This layer is about 7 inches thick and contains some stone fragments. The subsoil, below a depth of 15 inches, is a very firm, dense, dark grayish-brown to

olive-brown fragipan of channery silt loam. It extends to a depth of 45 inches. From a depth of 45 down to 60 inches or more, the substratum is dark grayish-brown to olive-brown, channery loam till that is about 40 percent coarse fragments. It is very firm and slightly calcareous.

Erie soils have a temporary water table within a few inches of the surface in spring and during wet periods. This water table is caused by the dense, very slowly permeable fragipan that is at a depth of 10 to 16 inches. Rooting depth is restricted to the zone above the fragipan. Available water capacity is moderate to low. In periods of normal rainfall, plants seldom are affected by lack of moisture, but during extended dry periods these soils are droughty. Natural fertility is medium.

Representative profile of Erie channery silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Sheldon; 20 feet from the north side of Schwab Road and one-fourth mile east of Cattaraugus Road:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) channery silt loam, dark grayish brown (10YR 4/2) rubbed; weak and moderate, medium, granular structure; friable; many fine roots; 15 percent coarse fragments; slightly acid; abrupt, smooth boundary.

A21—8 to 13 inches, pale-brown (10YR 6/3) channery silt loam; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; very weak, fine, subangular blocky structure; friable; many fine roots; common fine pores; 15 percent coarse fragments; medium acid; clear, wavy boundary.

A22—13 to 15 inches, light brownish-gray (2.5Y 6/2) channery silt loam; common, medium, distinct, yellowish-brown (10YR 5/4 and 5/6) mottles; massive to very weak, thin, platy structure; firm; common fine roots; common fine pores; 15 percent coarse fragments; medium acid; abrupt, wavy boundary.

Bx1—15 to 24 inches, dark grayish-brown (10YR 4/2) to olive-brown (2.5Y 4/4) channery silt loam; chroma of 3 dominant in matrix with thread-like pattern of grayish-brown (2.5Y 5/2) to gray (10YR 6/1) coats on discontinuous cleavage faces; strong very coarse prisms, 6 to 14 inches wide, separated by thin grayish-brown wedges that have strong-brown (7.5YR 5/6) outer rims; very weak, subangular blocky structure within prisms; very firm and brittle; few roots between prisms; common fine pores with clay linings in prisms; 20 percent coarse fragments; slightly acid; diffuse, wavy boundary.

Bx2—24 to 45 inches, dark grayish-brown (2.5Y 4/2) to olive-brown (2.5Y 4/4) channery silt loam; few, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; strong, very coarse prisms, 10 to 20 inches wide, separated by grayish-brown (2.5Y 5/2) silty coats; very firm and brittle; common fine pores with clay linings in prisms; 30 percent coarse fragments; neutral; clear, wavy boundary.

C—45 to 60 inches, dark grayish-brown (2.5Y 4/2) to olive-brown (2.5Y 4/4) channery loam; few, medium, dark yellowish-brown (10YR 4/4) mottles; massive to weak, thick, platy structure; very firm; common fine pores; 40 percent coarse fragments; slightly calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock ranges from 40 inches to many feet. Calcareous material is at a depth of 40 to 60 inches. The content of coarse fragments ranges from 10 to 25 percent in the surface horizons. This content increases with depth, and it ranges from 30 to 60 percent in the C horizon.

The Ap horizon has a hue of 2.5Y or 10YR, a value of 3 to 5, and a chroma of 2.

The A2 horizon has a hue of 5Y to 10YR, a value of 4 to 6, and a chroma of 2 or 3. Mottles range from common to many and fine to medium and have a higher chroma than the matrix. This horizon ranges from fine sandy loam to silt loam. Reaction ranges from strongly acid to slightly acid. Depth to the fragipan ranges from 10 to 16 inches.

The Bx horizon has a hue of 5Y to 10YR, a value of 4 or 5, and a dominant chroma of 2 or 3. This horizon is loam or silt loam, and individual subhorizons range from light loam to clay loam or silty clay loam because of the contrasting deposits in the drift. The reaction in the upper part of the horizon ranges from strongly acid to neutral, and it is neutral in the lower part.

Erie soils are similar to and occupy the same kind of landscapes as Darien and Volusia soils. They have a fragipan, which is lacking in the Darien soils, and they have a coarser textured B horizon than Darien soils. They are less acid in the fragipan than Volusia soils. Erie soils are similar to and associated on the landscape with wetter, poorly drained Ellery soils and with moderately well drained Langford and Mardin soils.

Erie silt loam, 0 to 3 percent slopes (ErA).—This nearly level soil has a profile similar to the one described as representative for the series, but it contains fewer channery stone fragments in the surface layer. This soil is in flat areas that receive very little runoff from higher adjacent slopes. Surface water remains longer on this soil than on the more sloping Erie soils. Individual areas are irregular in shape and are as much as 150 acres in size.

Included with this soil in mapping were areas of Dalton, Darien, Ellery, and Volusia soils. The poorly drained Ellery soils are in slight depressional areas and along drainageways.

This Erie soil can be used for crops, pasture, or trees. Extremes of wetness and dryness are the major limitations to use for crops. If adequately drained and properly managed, the soil is moderately well suited to field crops. Capability unit IIIw–2; woodland suitability group 3w5.

Erie channery silt loam, 3 to 8 percent slopes (EsB).—This soil has the profile described as representative for the series. It is gently sloping and is in areas that have little or no undulation. Runoff is received from higher adjacent soils.

Included with this soil in mapping were small areas of Dalton, Darien, Ellery, Fremont, Langford, and Volusia soils. Except for Ellery and Langford soils, these soils are on the same kind of landscape. Wetter Ellery soils were in small depressions and along drainageways, and drier Langford soils were on small knolls.

This Erie soil is suitable for crops, pasture, or trees. Extremes of wetness and dryness are the major limitations to use for crops. Adequate drainage is needed for moderate production. Erosion is a hazard if this soil is cultivated and not protected. Capability unit IIIw–6; woodland suitability group 3w5.

Erie channery silt loam, 8 to 15 percent slopes (EsC).—This moderately sloping soil is on the sides of valleys. The areas receive considerable amounts of runoff from higher adjacent areas. Many drainageways and shallow gullies cross this soil. Individual areas are commonly long and narrow.

Included with this soil in mapping were spots of Langford soils and very similar Fremont and Volusia soils. The Langford soil is similar to this soil, but it is better drained. Wetter areas caused by seepage water are indicated on the soil map by a symbol for wet spots. Also included were small areas of more sloping, eroded Erie soils.

This soil is suited to crops, pasture, or woodland. It can be used for general row crops if runoff and erosion are controlled. Slopes are a limitation to use of some ma-

chinery. Capability unit IIIe-9; woodland suitability group 3w5.

Fremont Series

The Fremont series is made up of deep, somewhat poorly drained soils that have a moderately fine textured subsoil. These soils formed in acid glacial till derived mainly from olive-gray silty shale that contains small amounts of shale that is dark and brittle or gray sandstone fragments. These soils are nearly level to steep. The areas are in the Allegheny Plateau in the south-central and northwestern parts of the county.

In a representative profile the surface layer is dark grayish-brown to dark-brown silt loam 9 inches thick. The subsoil is light silty clay loam that has prominent mottles. The upper part, to a depth of 18 inches, is grayish brown and is friable; the lower part, from a depth of 18 to 28 inches, is olive gray and is firm. The surface layer and the subsoil are very strongly acid, and they are 5 to 10 percent coarse fragments, mainly shale. The substratum, from a depth of 28 inches down to 50 inches or more, is firm, shaly silt loam till that has many prominent mottles. It is strongly acid.

These soils have a seasonal high water table within a few inches of the surface in spring and during wet periods. The rooting depth is 15 to 24 inches. Available water capacity is moderate to high. Permeability is moderately slow in the subsoil and slow in the substratum. Lime and fertilizer needs are high.

Representative profile of Fremont silt loam, 0 to 3 percent slopes, in a cultivated area in the town of Eagle on Telegraph Road, three-tenths mile east of Lyonsburg Road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) to dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure that crushes to weak, fine, granular; very friable; many roots; 5 percent coarse fragments; very strongly acid; abrupt, smooth boundary.

B21g—9 to 18 inches, grayish-brown (2.5Y 5/2) light silty clay loam; light olive-gray (5Y 6/2) ped faces; many, fine, prominent, yellowish-brown (10YR 5/6 and 5/8) mottles that have borders of olive brown (2.5Y 4/4); moderate, medium, subangular blocky structure; friable; few fine roots; common fine pores; 5 to 10 percent coarse fragments; very strongly acid; clear, wavy boundary.

B22g—18 to 28 inches, olive-gray (5Y 5/2) light silty clay loam; many, medium, prominent, strong-brown (7.5YR 5/6 and 5/8) mottles that have borders of light olive brown (2.5Y 5/4); moderate, coarse, subangular blocky structure in moderate coarse prisms; firm; few roots; few pores; gray to light-gray (5Y 6/1) silt coatings on ped faces; 10 percent coarse fragments; very strongly acid; clear, wavy boundary.

C—28 to 50 inches, gray (5Y 6/1) shaly silt loam; many, fine, prominent, dark yellowish-brown (10YR 4/4), reddish-brown (5YR 4/3), and olive (5Y 4/3) streaks; weak, medium, platy structure; firm; 25 percent soft shale fragments horizontally oriented; strongly acid.

The solum ranges from 24 to 38 inches in thickness. Bedrock is at a depth of 40 to 120 inches, but it generally is not much deeper than 40 inches. It is mainly soft shale, but it includes some thin-bedded sandstone. The content of coarse fragments ranges from 3 to 15 percent in the solum. These fragments are mainly shale and sandstone. The solum is strongly acid or very strongly acid in reaction.

The Ap horizon has a hue of 2.5Y or 10YR, a value 3 to 5, and a chroma of 2 or 3. The Ap horizon is silt loam or light silty clay loam.

The B horizon has a hue of 5Y or 10YR, a value 3 to 5, and a chroma of 2 to 4. Ped faces dominantly have a chroma of 2 or less. Mottles are of high chroma, are distinct or prominent, and occupy 40 to 50 percent of the matrix. This horizon is heavy silt loam or light silty clay loam. Structure is weak to moderate subangular blocky or prismatic.

In the C horizon the dominant chroma is 1 or 2. The content of shale fragments ranges from 15 to 35 percent. Structure of the C horizon is weak to moderate platy.

Fremont soils are similar to the Darien, Erie, Hornell, and Volusia soils. They lack the fragipan of the Erie and Volusia soils, and they are more acid than Erie and Darien soils. Fremont soils have a coarser textured B horizon than Hornell soils, and they lack the shale bedrock contact within a depth of 40 inches that is characteristic of Hornell soils. Fremont soils are closely associated with the wetter Ilion soils and in places with the shaly, moderately well drained Marilla soils. Fremont soils lack the fragipan of the Marilla soils.

Fremont silt loam, 0 to 3 percent slopes (FrA).—This nearly level soil has the profile described as representative for the series. Most areas are on the shaly till plateau in the northwestern part of the county. Some areas are on hilltops in the southern part. The landscape is nearly flat or slightly convex. Runoff is slow. Near Bennington, this soil commonly receives runoff from adjacent better drained soils. Individual areas vary in size and in shape.

Included with this soil in mapping were some areas of Fremont soils that are more shaly than this Fremont soil and some areas of shaly but drier Marilla soils near Bennington. Also included were spots of wetter Ilion soils and a soil that is similar to this Fremont soil but is wetter. These spots were in small low pockets and along drainageways.

This Fremont soil is suitable for crops, pasture, and trees. Seasonal wetness is a major limitation to use for crops. Lime and fertilizer needs are high. This soil has some potential for potato production because the low content of stones permits use of mechanical harvesters. Most areas are idle or are used for hay crops. Capability unit IIIw-1; woodland suitability group 3w2.

Fremont silt loam, 3 to 8 percent slopes (FrB).—This soil has a profile similar to the one described as representative for the series, but the surface layer generally is lighter in color and is a little thinner. This soil is gently sloping and is mainly in areas where runoff accumulates on the shaly till plateau near Bennington. Individual areas vary in size and in shape.

Included with this soil in mapping were small areas of a more shaly Fremont soil, better drained Marilla soils, and similar but less acid Darien soils. These inclusions make up as much as 30 percent of some mapped areas. Also included were spots of wetter Ilion soils along drainageways and in small depressions.

This Fremont soil is suited to crops, pasture, or trees. Most areas are idle or are farmed at a low level of intensity. Seasonal wetness and the hazard of erosion are the main limitations to use. Lime and fertilizer needs are high. This soil has some potential for potato production because the low content of stones permits use of mechanical harvesters. Capability unit IIIw-5; woodland suitability group 3w2.

Fremont channery silt loam, 8 to 15 percent slopes (FsC).—This soil generally is along hillsides in areas of the plateau. The profile is similar to that of the soil described as representative of the series except that an appreciable amount of flat, channery, sandstone fragments are throughout this soil. Also, many areas are better drained.

This soil is moderately sloping. More gently sloping soils generally are above areas of this soil, and steep soils are below. Most of the areas accumulate water from above, but some tend to shed water more quickly than others. Individual areas are about 50 acres or more in size.

Included with this soil in mapping, in the northwestern corner of the county, were areas that contain appreciable amounts of thin shale fragments. Also included were some areas that have very few fragments of any kind in the surface layer or in the upper part of the subsoil. A soil that is similar to this soil except that it is moderately well drained and its slopes are more convex was also included. Other inclusions were areas of Volusia and Hornell soils.

This Fremont soil is suited to crops, pasture, and trees. Seasonal wetness and a moderate hazard of erosion are limitations to use for crops. Very few areas of this soil are used for row crops. Hay is grown in some areas, but many areas are idle. Lime and fertilizer needs are high. Capability unit IIIe-9; woodland suitability group 3w3.

Fremont and Hornell soils, 15 to 25 percent slopes (FtD).—This mapping unit is made up of moderately steep Fremont and Hornell soils in sidehill areas of the pleateau. Either or both soils are in delineated areas, but both soils generally are present. In the northwestern corner of the county, most areas contain about equal amounts of each soil. Fremont soils are dominant in the remainder of the county. A few areas have profiles that are similar to the profile described as representative for their respective series, but most areas contain appreciable amounts of shale or channery sandstone fragments. Also, in most cleared areas the soil is severely eroded, and the surface layer is finer textured and lighter in color.

Included with this unit in mapping were areas of wetter soils around seep spots, commonly along the lower slopes of areas. Also included were spots of better drained Marilla and Manlius soils.

The areas of this mapping unit are mainly wooded or idle. Most cleared areas are eroded, and further erosion is a hazard if they are left exposed. Tillage should be limited to that necessary in reseeding pasture. Equipment is difficult and hazardous to operate on these sloping soils. Heavy applications of lime and fertilizer are needed for good pasture production. Capability unit VIe-3; woodland suitability group 3r2.

Fremont and Hornell soils, 25 to 40 percent slopes (FtE).—This mapping unit consists of steep Fremont and Hornell soils in long, narrow areas on the sides of hills. In most areas both soils are present, but the Fremont soil is dominant. Each of these soils contains more coarse fragments than the soil that has the profile described as representative for its respective series. Also, a fairly thick yellowish-brown layer is below the surface layer, because most of these soils have not been plowed. Individual areas are about 25 to 40 acres or more in size.

Included with these soils in mapping were some seep spots of wetter soils, mainly along foot slopes. Also included were some spots of better drained Manlius soils.

Most areas of this mapping unit are wooded or are idle. Capability unit VIIe-1; woodland suitability group 3r2.

Halsey Series

The Halsey series is made up of deep, very poorly drained soils that have a medium-textured to moderately coarse textured, gravelly subsoil. These soils formed in glacial outwash deposits. They are nearly level and are on outwash terraces or narrow valley stream terraces and in depressions in kame and kettle areas. Individual areas are throughout the county but are more common in the southern half.

In a representative profile the surface layer is black loam 8 inches thick. It contains a few pebbles. The upper part of the subsoil is friable, gray to grayish-brown gravelly loam about 17 inches thick. A few, distinct, yellowish-brown mottles are in this part of the subsoil. From a depth of 25 down to 28 inches, the lower part of the subsoil is friable, gray to grayish-brown gravelly sandy loam. This layer is slightly acid, and it is distinctly mottled. Between depths of 28 to 50 inches or more, the substratum is grayish-brown very gravelly loamy sand. It is slightly acid and stratified.

Halsey soils, in undrained areas, have a water table that is at the surface late in spring. Rooting depth is mainly 10 to 12 inches. Available water capacity is moderate but is somewhat dependent on rooting depth. Permeability is moderate in the surface layer, moderately rapid in the subsoil, and rapid in the substratum. Natural fertility is medium and is enhanced by the relatively high organic-matter content of the upper layers. Lime needs are medium to low. If adequate drainage outlets are present, these soils can be drained and used for crops.

Representative profile of Halsey loam in an idle area in the town of Wethersfield, one-half mile east of the hamlet of Wethersfield Springs on the south side of County Road No. 32:

Ap—0 to 8 inches, black (10YR 2/1) loam; moderate, fine and medium, granular structure; very friable, slightly sticky; many fine roots; 5 to 10 percent gravel; slightly acid; abrupt, smooth boundary.

B2g—8 to 25 inches, gray (10YR 5/1) to grayish-brown (2.5Y 5/2) gravelly loam; few to common, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; nonsticky; few fine roots; porous; 25 percent gravel; medium acid; clear, wavy boundary.

B3g—25 to 28 inches, gray (10YR 5/1) to grayish-brown (10YR 5/2) gravelly sandy loam; common, medium, faint, brown (10YR 5/3) and distinct yellowish-brown (10YR 5/4) mottles; very weak, medium, subangular blocky structure and some weak, thick, platy structure; friable; nonsticky; porous; 30 percent gravel; slightly acid; clear, wavy boundary.

IIC—28 to 50 inches, grayish-brown (10YR 5/2) very gravelly loamy sand; stratified; single grain; loose, nonsticky; very porous; 50 percent gravel; slightly acid.

The solum ranges from 24 to 36 inches in thickness. Bedrock is at a depth of 4 to 50 feet or more. Coarse fragments are mainly pebbles but include cobblestones. The content of coarse fragments ranges from 5 to 30 percent to a depth of 25 inches and from 35 to 60 percent between depths of 25 and 40 inches. The solum ranges from medium acid to neutral in reaction.

The Ap horizon has a hue of 10YR, a value of 2 or 3, and a chroma of 1 or 2. It ranges from sandy loam to silt loam in texture and is 5 to 20 percent coarse fragments.

The B horizon has a hue of 7.5YR to 2.5Y, a value of 4 to 6, and a chroma of 0 to 2. Subhorizons range from sandy loam to silt loam in texture and are 15 to 35 percent coarse fragments.

The C horizon is stratified sand and gravel and has some interbedded material of slightly heavier texture. Reaction is medium acid to mildly alkaline above a depth of 40 inches.

Halsey soils are associated with the drier Castile, Chenango, Homer, Howard, and Red Hook soils that formed in similar material. They are similar to soils of the Alden and Sun series on uplands. Halsey soils are similar to Papakating soils on

flood plains, but they are less silty and have gravel in upper layers that is lacking in the Papakating soils.

Halsey loam (Ha).—This level or nearly level soil is the only Halsey soil mapped in the county. It receives a large amount of runoff and subsurface seepage from adjacent soils. In kame and kettle landscapes, areas are small and generally are circular. In other areas, size and shape vary considerably. Individual areas range from 5 to 60 acres or more in size.

Included with this soil in mapping were areas of Papakating soils and associated, drier, gravelly soils on slight rises and along the edges of mapped areas. Also included were some areas of soils that have a mucky surface layer.

This Halsey soil generally is suited to wetland species of grasses for pasture and to trees. It has limited value for farming because of prolonged wetness. In most areas it is difficult to locate sufficiently low outlets to lower the water table enough for crops. If these soils are drained, many crops associated with dairy and cash-crop enterprises can be grown. Capability unit IVw–2; woodland suitability group 4w2.

Hamlin Series

The Hamlin series is made up of deep, well-drained, medium-textured soils that formed in silty alluvial deposits. These soils are nearly level and are on flood plains along meandering streams in the larger valleys in the northern half of the county and along the valley of the Genesee River in the southeastern part of the county.

In a representative profile the surface layer is a very dark grayish-brown silt loam 9 inches thick. The subsoil is friable, neutral silt loam that extends to a depth of 42 inches. The upper part, from a depth of 9 down to 22 inches, is dark grayish brown, and the lower part, from a depth of 22 down to 42 inches, is brown to dark brown. The substratum is dark grayish-brown, friable silt loam that extends to a depth of more than 61 inches. It is mildly alkaline.

Hamlin soils are subject to flooding from nearby streams, generally in spring. The flooding is of short duration, generally not more than a day; and as the water level of the stream recedes, the subsequent high water table recedes rapidly. Rooting depth generally is unrestricted and is 40 inches or more in places. Available water capacity is high. Permeability is moderate. Natural fertility is medium to high, partly because of the high organic-matter content. Lime needs are low. Hamlin soils are limited in acreage, but they are among the better soils in the county for farming. They are easy to manage.

Representative profile of Hamlin silt loam in a cultivated field in the town of Middlebury; three-fourths mile south of the village of Wyoming, just south of Oatka Creek bridge on School Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) when dry; moderate, medium, granular structure; friable; many roots; many fine pores; neutral; abrupt, smooth boundary.

B21—9 to 22 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, subangular blocky structure in very weak, coarse prisms; friable; many fine roots; many pores; neutral; gradual, smooth boundary.

B22—22 to 42 inches, brown to dark-brown (10YR 4/3) silt loam; very weak, coarse, prismatic structure; friable; common fine roots; many pores; neutral; gradual, smooth boundary.

C—42 to 61 inches, dark grayish-brown (10YR 4/2) silt loam; few strata of fine sandy loam; massive; friable; mildly alkaline.

The solum ranges from 35 to 60 inches in thickness. Carbonates are at a depth of more than 40 inches. Bedrock generally is at a depth of 6 feet or more. Water-sorted pebbles or cobblestones are below a depth of 40 inches in places. The solum ranges from slightly acid to neutral. The solum and substratum have a hue of 10YR or 2.5Y. The solum is not saturated for long periods.

The Ap horizon has a value of 3 or 4 when moist and 6 or 7 when dry, and it has a chroma of 2 or 3. This horizon ranges from silt loam to fine sandy loam.

The B horizon has a value of 3 to 5 when moist and 6 or 7 when dry, and it has a chroma of 2 to 4. This horizon is mainly silt loam and very fine sandy loam. It is less than 18 percent clay. Mottles generally are absent, but a few faint mottles are below a depth of 24 inches in places. This horizon has mainly prismatic structure.

Hamlin soils are closely associated on flood plains with the wetter Teel, Wallkill, and Wayland soils that formed in similar material. They are also near shaly Herkimer and gravelly Palmyra soils on adjacent outwash terraces and fans.

Hamlin silt loam (Hc).—This soil is the only Hamlin soil mapped in the county. It is nearly level and, in some areas along the Genesee River, is underlain by layers of gravel and coarse sand. It is in the highest parts of the flood plains, commonly adjacent to the main streams. Individual areas are in strips within the flood plains and are parallel to the main stream. They range from less than 5 acres to 20 acres in size.

Included with this soil in mapping were areas of moderately well drained Teel soils in small depressions on the flood plains.

This soil is well suited to most crops. It is easy to cultivate, and it responds well to good management. Streambank erosion is a hazard in places. Areas on higher terraces are not so subject to flooding, except during catastrophic storms. This soil is an extremely good source of topsoil for landscaping. Capability unit I–2; woodland suitability group 2o3.

Herkimer Series

The Herkimer series is made up of deep, well drained to moderately well drained, medium-textured, medium-lime soils that formed in poorly sorted, shaly gravel deposits. These soils are nearly level to gently sloping and are on glacial outwash fans along the foot slopes of the valley sides in the Oatka, Little Tonawanda, and Tonawanda Valleys in the northern part of the county.

In a representative profile the surface layer is very dark grayish-brown shaly silt loam 8 inches thick. The subsoil, from a depth of 8 down to 38 inches, is friable, neutral, porous, dark-brown to brown shaly silt loam that contains about 25 percent shale fragments. The substratum, from a depth of 38 to 45 inches, is friable, dark grayish-brown very shaly loam that contains about 55 percent shale fragments. It is neutral. From a depth of 45 to 60 inches or more, the substratum is stratified, and it is mildly alkaline.

Herkimer soils have a water table that generally is below a depth of 24 inches. These soils have good potential for root development. Rooting depth generally is unrestricted and commonly extends to 30 inches or more. Available water capacity is moderate. Permeability is moderate to moderately rapid in the surface layer and subsoil and

rapid in the substratum. Natural fertility is medium to high. Lime needs are low. These soils are used intensively for crops.

Representative profile of Herkimer shaly silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Middlebury; 1½ miles south-southwest of the village of Wyoming, along State Route 19:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) shaly silt loam; moderate, medium, granular structure; very friable; many fine roots; 20 percent shale fragments; neutral; abrupt, smooth boundary.

B21—8 to 22 inches, dark-brown to brown (10YR 4/3) shaly silt loam; moderate, fine and very fine, subangular blocky structure; friable; many fine roots; porous; 25 percent shale fragments; neutral; gradual, smooth boundary.

B22—22 to 38 inches, dark-brown (10YR 3/3) shaly silt loam; moderate, fine and very fine, subangular blocky structure; friable; common fine roots; porous; 25 percent shale fragments; neutral; gradual, wavy boundary.

IIC1—38 to 45 inches, dark grayish-brown (10YR 4/2) very shaly loam; weak, medium, subangular blocky structure with some platiness; friable; few roots; porous; 55 percent shale fragments; neutral; clear, wavy boundary.

IIC2—45 to 60 inches, dark grayish-brown (10YR 4/2) very shaly loam; crudely stratified; very friable; porous; 60 percent shale fragments; mildly alkaline.

The solum ranges from 30 to 48 inches in thickness. The content of coarse fragments, mostly shale, ranges from 5 to 30 percent in the solum. The solum ranges from medium acid to neutral in the upper part and is neutral in the lower part. In some profiles the soil material is calcareous below a depth of 50 inches.

The Ap horizon has a hue of 10YR or 2.5Y, a value of 2 or 3, and a chroma of 2. This horizon has weak to moderate granular structure.

The B horizon has a hue of 10YR or 2.5Y, a value of 3 or 4, and a chroma of 2 or 3. Some high-chroma mottles are below a depth of 20 inches in places. This horizon generally is silt loam but ranges to loam. It has weak to moderate granular or subangular blocky structure. Consistence is firm or friable.

The C horizon generally has some weak stratification. The content of coarse fragments ranges from 35 percent to 70 percent, by volume.

Herkimer soils are commonly near Hamlin, Teel, Wallkill, and Wayland soils, which are on flood plains around the fringes of the Herkimer soils on foot slopes of fans. Herkimer soils also occupy similar landscapes to those occupied by some of the Castile, Chenango, and Scio soils. They are less acid than these soils. The coarse fragments in Herkimer soils are shale rather than channery and flaggy sandstone as in Castile and Chenango soils. Herkimer soils contain coarse fragments, which are lacking in the Scio soils.

Herkimer shaly silt loam, 0 to 3 percent slopes (HeA).—This soil has a profile similar to the one described as representative for the series, but the content of shale is slightly lower. This nearly level soil is in slightly convex shaly fan outwash areas that are between steep dissected valley sides and valley bottoms or between gently sloping fan areas and the valley floor. This soil is nearly level, but it has a low slope gradient toward the valley bottom. Individual areas generally are fan shaped. They range from 5 to 40 acres or more in size.

Included with this soil in mapping were areas of gently sloping Herkimer soils at the head slopes of this soil. Also included were areas of wetter silty soils on alluvium on foot slopes where this Herkimer soil merges with the valley bottom. Areas of soils similar to this one except that they are slighly wetter were also included.

This soil is well suited to intensive farming. Row crops, such as corn, grown in support of dairy farming grow well. Occasional flooding of the lower boundaries of this soil from the main stream and infrequent flooding from side streams delays early-season tillage in some years. Flooding is of short duration, and the water level recedes rapidly after the stream level drops. A temporary high water table is a more serious limitation to early-season use than it is on the gently sloping Herkimer soils. In places efficient machinery operation is difficult because of small areas, position between wetter and steeper soils, and dissection by side streams. Capability unit I-1; woodland suitability group 2o2.

Herkimer shaly silt loam, 3 to 8 percent slopes (HeB).—This gently sloping soil has the profile described as representative for the series. It has convex slopes and is on shaly outwash fans between steep valley sides and flood plains. Individual areas range from 5 to 40 acres or more in size, but along the Oatka Valley where areas tend to merge, the landscape has a gently rolling appearance.

Included with this soil in mapping were small areas of Herkimer soils that have slopes of as much as 12 percent. These areas are commonly closest to the fan apex. Also included were areas of nearly level Herkimer soils, wetter soils on alluvium on foot slopes, and small areas of similar, but slightly wetter, soils.

This soil is well suited to intensive farming. Crops, such as corn and alfalfa that are associated with dairying, grow well on these soils. Flooding from side streams entering the valley is a slight hazard about one year in 20. When flooding does occur, runoff is rapid, and early season tillage is not hampered to any great extent. A temporary high water table is not so important a limitation on this soil as it is on the less sloping Herkimer soils. Efficient operation of machinery is difficult in places because of the small size of the area, its position between wetter and steeper soils, and dissection of the area by side streams. Under a high level of management that includes application of fertilizer, this soil is among the better suited soils in the dairy region of the county. The hazard of erosion is slight if this soil is cultivated and not protected. Capability unit IIe-1; woodland suitability group 2o2.

Homer Series

The Homer series is made up of nearly level, deep, somewhat poorly drained, medium-textured soils that formed in medium- to high-lime gravelly outwash. Most Homer soils are on low terraces along the larger streams in the northern half of the county.

In a representative profile the surface layer is very dark grayish-brown gravelly loam 9 inches thick. The subsurface layer is mottled grayish-brown gravelly loam that extends to a depth of about 14 inches. The surface and subsurface layers are slightly acid. The subsoil, from a depth of 14 down to 35 inches, is sticky gravelly loam that is friable and neutral. It is mottled brown to dark brown in the upper part and dark grayish brown below a depth of about 20 inches. The substratum, from a depth of 35 down to 55 inches or more, is stratified sand and gravel that is loose and calcareous.

Homer soils have a low to medium capacity to supply nutrients. Available water capacity is low to moderate. A temporary high water table is a few inches below the surface in spring and during wet periods. Unless drained, the rooting depth is mainly in the upper 15 to 20 inches.

Response to tile drainage is good and is essential for most row crops. A moderate amount of surface gravel is present, but it generally does not hinder most tillage operations.

Representative profile of Homer gravelly loam in a cultivated field in the town of Orangeville on U.S. Highway No. 20A, one-half mile southeast of the village of Varysburg, 300 feet south of U.S. Highway No. 20A:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) gravelly loam, light brownish gray (10YR 6/2) when dry; moderate, fine, granular structure; very friable; many fine roots; common fine pores; 25 percent gravel; slightly acid; abrupt, smooth boundary.

A2g—9 to 14 inches, grayish-brown (10YR 5/2) gravelly loam; many, medium, distinct, brown (7.5YR 5/4) and yellowish-brown (10YR 5/6) mottles; weak, medium, platy structure; friable; common fine roots; common fine pores; 30 percent gravel; slightly acid; clear, irregular boundary.

B21t—14 to 20 inches, brown to dark-brown (10YR 4/3) gravelly loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common fine roots; few pores; patchy clay films on ped faces; 30 percent gravel; dark grayish-brown (10YR 4/2) ped faces; neutral; clear, wavy boundary.

B22t—20 to 35 inches, dark grayish-brown (10YR 4/2) gravelly loam; many, fine, faint and distinct, brown to dark-brown (10YR 4/3) and yellowish-brown (10YR 5/6) mottles; weak to moderate, medium, subangular blocky structure; friable; few roots; few pores; clay films on ped faces; 35 percent gravel; neutral; clear, wavy boundary.

IIC—35 to 55 inches, gray to grayish-brown (10YR 5/1 and 5/2) gravel and sand; stratified; loose; 50 percent gravel; calcareous; moderately alkaline.

The solum ranges from 24 to 38 inches in thickness. Bedrock is at a depth of 4 to 50 feet or more. The solum is 5 to 35 percent, by volume, coarse fragments that are mainly gravel.

The Ap horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 2. The A2g horizon has a hue of 10YR or 2.5Y, a value of 5 or 6, and a chroma of 2 or 3. Many high-chroma mottles are in this horizon. Texture ranges from sandy loam to silt loam. Reaction is medium acid to neutral.

The Bt horizon has a hue of 10YR, a value of 4 or 5, and a chroma of 2 or 3. This horizon is heavy sandy loam, loam, or sandy clay loam. It has weak or moderate subangular blocky structure. It ranges from slightly acid to mildly alkaline in reaction. Clay films cover 25 to 60 percent of the ped faces and become more prominent as depth increases.

The IIC horizon consists of stratified, calcareous sand and gravel. It contains a thin silt or clay stratum in places. Some thin noncalcareous zones are just below the solum in places. The content of coarse fragments ranges from 30 to 70 percent, by volume, in this horizon.

Homer soils are on landscapes similar to those of the Niagara, Red Hook, and Wallington soils. These soils contain gravel that is lacking in Niagara and Wallington soils and they are less acid than Red Hook and Wallington soils. Homer soils are on outwash terraces closely associated with wetter Halsey soils and with drier Palmyra and Phelps soils that formed in similar material.

Homer gravelly loam (Hg).—This soil has the profile described as representative for the series. It is nearly level and is on glacial stream terraces. It commonly is between drier Palmyra or Phelps soils at slightly higher elevation and Halsey soils in adjacent depressional areas or drainageways. It also is in the lowest area within higher and drier terrace soils in places. Individual areas are irregular in shape and range from 10 to 30 acres or more in size.

Included with this soil in mapping were some areas of soils that have a surface layer of loam or silt loam that is much less gravelly that than of this Homer soil. Also included were small areas of wetter Halsey soils along drainageways and areas of drier Phelps soils on slight rises.

This Homer soil is suited to crops used in dairying. Unless artificially drained, this soil is mainly used for hay, summer grain, and pasture. Corn and dry beans grow well if the soil is drained. Capability unit IIIw-1; woodland suitability group 3w4.

Homer gravelly loam, clayey substratum (Hh).—This soil has a profile similar to the one described as representative for the series, but thick beds of glacial lake clay and silty clay underlie this soil at depths of 5 to 10 feet. This nearly level soil is in the wetter areas adjacent to Varysburg soils, rather than adjacent to Howard, Palmyra, or Phelps soils. Areas are irregular in shape and range from 5 to 25 acres in size.

Included with this soil in mapping were some very gently sloping soils on gravelly outwash fans at the footslopes of the valley sides. Parts of these fans have overrun the glacial lake clay beds.

This Homer soil is suited to crops used in dairying. Unless artificially drained, this soil is mainly used for hay, summer grain, and pasture. Corn and dry beans grow well if the soil is drained. Capability unit IIIw-1; woodland suitability group 3w4.

Hornell Series

The Hornell series is made up of moderately deep, somewhat poorly drained to moderately well drained, medium-textured soils that have a moderately fine textured to fine-textured subsoil. These soils formed in acid glacial till derived mainly from olive-gray, soft, clayey shale. They are nearly level to steep and are on areas of the Allegheny Plateau, mostly in the northwestern part of the country.

In a representative profile, in a wooded area, the surface layer is very dark grayish-brown silt loam 5 inches thick. The upper part of the subsoil is light olive-brown, friable, very strongly acid silty clay loam about 7 inches thick. It has some distinct mottles. From a depth of 12 down to 30 inches, the subsoil is strong brown and is prominently mottled with gray and light gray. It is firm and very strongly acid. The subsoil is silty clay loam from a depth of 12 down to 20 inches and silty clay from a depth of 20 down to 30 inches. The surface layer and subsoil contain 5 to 10 percent soft shale fragments. Below a depth of 30 inches is soft shale bedrock that is very strongly acid. In places where this soil has been cultivated, the plow layer is 6 to 8 inches thick.

Hornell soils have very low natural fertility. Because of the low level of past farming, the clayey subsoil, and the low natural fertility, these soils need more lime and fertilizer to produce adequate crops than any other soil in the county. Available water capacity is low to moderate. Permeability is moderately slow in the surface layer and very slow in the subsoil. Soft shale bedrock is at a depth of 20 to 40 inches. Seasonal wetness and very slow permeability caused by the fine texture of the subsoil are the main limitations to use.

Representative profile of Hornell silt loam, 3 to 8 percent slopes, in a wooded area in the town of Bennington on Ortner Road, about one-third mile south of Genesee County line:

A1—0 to 5 inches, very dark grayish-brown (2.5Y 3/2) silt loam; moderate, medium, granular structure; friable;

many roots; 5 percent shale fragments; very strongly acid; clear, smooth boundary.

B21—5 to 12 inches, light olive-brown (2.5Y 5/4) light silty clay loam; common, medium, faint, yellowish-brown (10YR 5/6) and distinct light brownish-gray (2.5Y 6/2) mottles; moderate, medium, subangular blocky structure; friable; many roots; common fine pores; 5 to 10 percent shale fragments; very strongly acid; clear, wavy boundary.

B22—12 to 20 inches, strong-brown (7.5YR 5/6) silty clay loam that is streaked with many, prominent, gray to light-gray (10YR 6/1) mottles; strong, medium, angular blocky structure in moderate medium prisms; firm; few medium roots; common fine pores; light brownish-gray (2.5Y 6/2) ped coats; 5 percent shale fragments; very strongly acid; clear, wavy boundary.

B23—20 to 30 inches, strong-brown (7.5YR 5/6) silty clay; interior streaked with many, prominent, gray (10YR 5/1) mottles; moderate, medium, platy structure in weak, coarse prisms; firm; olive-gray (5Y 5/2) silt coats on prism faces; 5 to 10 percent shale fragments; very strongly acid; gradual, smooth boundary.

R—30 inches +, gray (N 5/0) soft shale bedrock; many, prominent, olive-brown (2.5Y 4/4) and yellowish-brown (10YR 5/6) streaks and mottles; moderate, medium, platy structure; firm; very strongly acid.

The solum ranges from 20 to 36 inches in thickness. Bedrock is mainly soft shale and is at a depth of 20 to 40 inches. The content of hard coarse fragments ranges from 0 to 10 percent.

The A1 horizon has a hue of 10YR or 2.5Y, a value of 4 or 5, and a chroma of 2 or 3. In places an Ap horizon that is 6 to 8 inches thick is present. It is very strongly acid or strongly acid unless limed.

In the B horizon ped faces have coats that have a hue of 10YR to 5Y, a value of 4 to 6, and a chroma of 1 to 3. They have chroma of 7 or less at a depth of more than 16 inches. The interior is streaked with gray that threads into areas of olive brown and strong brown that occupy 60 to 80 percent of the matrix. This horizon is silty clay loam or silty clay. It has weak to strong, blocky or prismatic structure.

A thin C horizon is present in places. It differs from the B horizon in that it is more shaly and has more platy structure.

Hornell soils are similar to the deeper Caneadea and Fremont soils. In addition to being moderately deep over shale, Hornell soils are more acid than the Caneadea soils of similar texture. They have a finer textured B horizon than Fremont soils.

Hornell silt loam, 0 to 3 percent slopes (HlA).—This nearly level soil has a profile similar to the one described as representative for the series, but it generally is a little wetter and is on the shaly till plateau near the town of Bennington. The terrain is mainly slightly convex. This soil generally receives no runoff from adjacent areas. Individual areas are small and of very limited extent. Large parts of the areas have been cultivated in the past, and some are now being cultivated.

Included with this soil in mapping were cultivated areas where the light olive-brown layer just below the surface has been incorporated into the plow layer. Spots of coarser textured and deeper Fremont soils were the principal inclusions. Also included were a few areas of soils that have a hard layer underlying the soil rather than the very soft bedrock that is typical of this Hornell soil. Some small areas of soil were also included that are slightly deeper than 40 inches to bedrock as well as a few areas of wetter soils.

This Hornell soil is suited to crops, pasture, or trees. Major limitations to use of this soil for crops are seasonal wetness and very low fertility. Good tilth is difficult to maintain. Most areas of this soil are wooded or are idle. Capability unit IIIw-3; woodland suitability group 3w2.

Hornell silt loam, 3 to 8 percent slopes (HlB).—This soil has the profile described as representative for the series. Most of the acreage of this gently sloping soil is on the shaly till plateau in the northwestern part of the county. A few small areas are in the southern half of the county. Slopes are convex. Areas are in higher positions on landscapes or are on some foot slopes below such soils as those of the Manlius or Marilla series. Soft shale bedrock commonly underlies this soil at a depth of about 30 inches.

Included with this soil in mapping, in places, were areas of soils that have a surface layer of silty clay loam because of past erosion. In these areas a light olive-brown layer just under the surface layer is incorporated into the plow layer. Also included were areas of coarser and deeper Fremont soils. In places areas where the substratum is hard shale were included. Also included were areas where the depth to bedrock is more than 40 inches. The inclusions make up about 30 percent of the areas.

This Hornell soil is suited to crops, pasture, or trees. Seasonal wetness, the hazard of erosion, and very low fertility are major limitations to the use of these soils for crops. Many areas are wooded or are idle. Where past erosion has exposed the silty clay loam subsoil, the surface layer is lumpy, and available water capacity is lower. Capability unit IIIw-4; woodland suitability group 3w2.

Hornell silt loam, 8 to 15 percent slopes (HlC).—This soil has a profile similar to the one described as representative for the series, especially in wooded areas. In cleared areas, which are of small extent, about two-thirds of the soil is eroded enough for the silty clay loam or silty clay subsoil to be exposed at this surface. This soil is moderately sloping in areas of the shaly till plateau in the northwestern part of the county. Individual areas generally are long and narrow. Most areas of this soil are on the sides of shelflike landforms, ascending southward into the plateau from the Genesee County line.

Normally the underlying shale beds are rather soft, but included with this soil in mapping were large areas where harder shale is also present. Also included were spots of coarser and deeper Fremont soils that are somewhat deeper to bedrock than Hornell soils.

Most of this Hornell soil is wooded. Areas that are not wooded are idle or in crops used for dairy farming. Erosion is a serious hazard if this soil is cultivated and not protected. Seasonal wetness and very low fertility are major limitations. Where past erosion has exposed the silty clay loam subsoil, the surface layer is lumpy, and the available water capacity is lower. Capability unit IIIe-8; woodland suitability group 3w3.

Howard Series

The Howard series is made up of deep, well-drained to somewhat excessively drained soils that have a medium-textured to moderately coarse textured, gravelly subsoil. These soils formed in glacial outwash deposits. The deposits are mainly a mixture of limestone and sandstone gravel, but shale is dominant in some areas. These soils are nearly level to gently sloping where they are on outwash terraces. They are rolling to steep in kettle-kame areas of the landscape. Most of these soils are throughout the west-central part of the county.

In a representative profile the surface layer is dark gray-

ish-brown gravelly loam 8 inches thick. Underlying this is a leached, friable, yellowish-brown, very gravelly loam layer, 12 inches thick, that interfingers into the upper part of the subsoil at a depth of about 20 inches. The upper part of the subsoil, from a depth of 20 down to 36 inches, is friable, pale-brown and brown very gravelly loam that is slightly acid. At a depth of about 36 inches, the lower part of the subsoil is brown to dark-brown very gravelly loam. This layer is higher in content of clay than the layers above and below. The clay is present as coatings on the gravel. Reaction is neutral in this layer and the content of gravel is as much as 70 percent. A substratum of grayish-brown, stratified sand and gravel that is calcareous is at a depth of about 45 inches and extends to a depth of 70 inches or more.

Howard soils are porous, and rooting depths are 30 inches or more. The water table generally is at a depth of more than 40 inches. Available water capacity is low to moderate. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. Natural fertility is medium to low, and lime needs are medium. These soils dry out rapidly in spring and are among the earliest soils in the county ready for cultivation. In places coarse gravel fragments are a slight limitation for some tillage operations.

Representative profile of Howard gravelly loam, 3 to 8 percent slopes, in a cultivated area in the town of Genesee Falls; one-half mile north of Denton Corners on State Route 19A, in a field on east side of road:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, medium, granular structure; very friable; many fine roots; 30 percent gravel; strongly acid; abrupt, smooth boundary.

A2—8 to 20 inches, yellowish-brown (10LR 5/6) very gravelly loam; weak, medium, subangular blocky structure; friable; common fine roots; many pores; 40 percent gravel; strongly acid; gradual, wavy boundary.

A&B—20 to 25 inches, brown (7.5YR 4/4) very gravelly loam; pale brown (10YR 6/3) around peds; mainly very weak, fine, subangular blocky structure but platy in places; friable; common fine roots; 45 percent gravel; medium acid; clear, irregular boundary.

B1—25 to 36 inches, brown (7.5YR 4/4) very gravelly loam; moderate, fine and medium, subangular blocky structure; friable; few roots; many pores; patchy clay films in pores, most pebbles coated; 45 percent gravel; slightly acid; gradual, wavy boundary.

B2t—36 to 45 inches, brown to dark-brown (10YR 4/3) very gravelly heavy loam, parts of it resemble a completely clay-coated porous gravel stratum; weak, subangular, blocky structure that is affected by gravel content; friable; few roots; porous; 50 to 70 percent gravel; neutral; abrupt, irregular boundary.

IIC—45 to 70 inches, grayish-brown (10YR 5/2) stratified sand and gravel; single grain; loose; 50 to 80 percent gravel; calcareous; moderately alkaline.

The solum ranges from 28 to 60 inches in thickness and corresponds closely to the depth to carbonates. Bedrock or contrasting till is at a depth of more than 6 feet and generally is at a depth of 50 feet or more. Coarse fragments are mainly pebbles but include cobblestones and other rounded fragments. The solum ranges from strongly acid to medium acid in the upper part and slightly acid to mildly alkaline in the lower part.

The Ap horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 2. This horizon ranges from gravelly loam to shaly silt loam.

The A2 horizon has a hue of 10YR or 7.5YR, a value of 4 or 5, and a chroma of 3 to 6. It contains 5 to 40 percent coarse fragments, by volume. It ranges from sandy loam to silt loam.

The B horizon has a hue of 10YR or 7.5YR, a value of 4 to 5, and a chroma of 3 or 4. This horizon ranges from loam or sandy loam to light sandy clay loam. The content of coarse fragments ranges from 35 to 70 percent.

The C horizon is stratified, calcareous sand and gravel. Tongues of B horizon material intrude this horizon. A thin zone of noncalcareous C horizon is just under the solum in some profiles.

Howard soils are similar to the Chenango and Palmyra soils. They are less acid than Chenango soils and have a thicker solum over carbonates than Palmyra soils. Howard soils are closely associated with the very poorly drained Halsey soils, the somewhat poorly drained Homer soils, and the moderately well drained Phelps soils that formed in similar material.

Howard gravelly loam, 0 to 3 percent slopes (HmA).—This soil has a profile similar to the one described as representative for the series, but it is nearly level and is in areas of glacial outwash terraces in valleys. This soil is adjacent to more sloping Howard soils in undulating areas or on terrace escarpments. Areas range from 10 to about 50 acres in size.

Included with this soil in mapping, in slight depressions, were small areas of wetter Phelps and Homer soils.

This Howard soil is suited to crops, pasture, or woodland. During long dry periods, lack of water is a slight limitation. Early-season crops, such as potatoes and peas, grow well in this soil. This soil can be used for most other crops commonly grown in the county. It is especially suited to deep-rooted crops. Mechanical harvesting of potatoes is limited by the high content of rounded stones. Depending on past cropping history, the lime and fertilizer needs are variable, but intensive use of fertilizer generally is needed. Capability unit IIs–1; woodland suitability group 2o2.

Howard gravelly loam, 3 to 8 percent slopes (HmB).—This soil has the profile described as representative for the series. It is gently sloping or undulating and is on glacial outwash terraces in valleys. It generally is between level soils on the tops of the terraces and the more sloping soils on terrace escarpments. Individual areas are 10 to 30 acres in size.

Included with this soil in mapping were Homer and Phelps soils in low pockets. A few of these areas are shallower to contrasting till or slack water sediment.

This Howard soil is well suited to crops, pasture, or trees. During long dry periods lack of water is a slight limitation. Lime and fertilizer needs depend on cropping history and the crops grown, but intensive use commonly is justified, especially if winter cover crops are used. The hazard of erosion is slight in places if this soil is cultivated and not protected. Capability unit IIs–2; woodland suitability group 2o2.

Howard gravelly loam, 8 to 15 percent slopes (HmC).—This soil has a profile similar to the one described as representative for the series, but the upper part of the subsoil generally is thinner. This soil is moderately sloping or rolling. The moderately sloping soil generally is on the sides of larger terraces where slope is in one general direction. The rolling soil is one of a series of moderately sloping soils or knolls where slope is in many directions. Most of the acreage of this soil is on this rolling type of terrain. Individual areas range from 10 to 30 acres in size.

Included with this soil in mapping, in places on the steepest parts of the knolls, were areas of moderately eroded soil. In these areas the material from the eroded soil accumulates between the knolls in wetter pockets, and the original surface layer commonly is buried below plow depth.

This Howard soil is suited to crops, pasture, or trees.

Complex topography makes intensive use and control of erosion difficult. Also, this soil tends to be more droughty than lesser sloping Howard soils. Sod-forming crops generally are grown as often as half the years in a cropping sequence. Capability unit IIIe-1; woodland suitability group 2o2.

Howard gravelly loam, 15 to 25 percent slopes (HmD).—This soil has a profile similar to the one described as representative for the series, but in most areas the soil has been eroded so that the surface layer generally is thinner and lighter colored. It is moderately steep and hilly and is in valleys. The areas of moderately steep soil are on the sides of larger terraces where slope is in one direction, and the hilly soil is in a complex of hills where slope is in many directions. Individual areas range from 10 to 30 acres in size.

Included with this soil in mapping were areas of soils that are more sandy and less gravelly than typical Howard soils. The depressions in the hilly slopes and the toe slopes of the side slopes have a large accumulation of soil from adjacent higher areas.

This Howard soil is suited to pasture, trees, and to limited cultivation. Erosion is a hazard, and this soil is droughty. Although it is possible to cultivate most areas, this soil is better suited to permanent cover. It is fairly well suited to alfalfa hay. Capability unit IVe-1; woodland suitability group 2r3.

Howard shaly silt loam, 0 to 3 percent slopes (HnA).—This soil has a profile similar to the one described as representative for the series, but the coarse fragments are silty shale rather than hard limestone and sandstone. Also, the texture is more silty and less sandy. This soil is nearly level and is on deltas in valleys, mainly in the northern and northwestern parts of the county where the underlying bedrock is shale. This shale has contributed to the fragments that are in the soil. Individual areas range from 10 to 30 acres in size. This soil is of limited extent.

Included with this soil in mapping were small areas of shaly Chenango and Palmyra soils.

This Howard soil is suited to crops, pasture, and trees, and it is suited to those crops that are commonly grown in the county. During extended dry periods, plants show signs of lack of moisture. This soil responds well to proper management. Capability unit IIs-1; woodland suitability group 2o2.

Howard shaly silt loam, 3 to 8 percent slopes (HnB).—This soil has a profile similar to the one described as representative for the series, but the coarse fragments are mainly silty shale rather than hard limestone and sandstone. Also, the texture is more silty and less sandy. This soil is gently sloping or undulating and is on deltas in valleys, mainly in the northern and northwestern parts of the county. Individual areas are about 10 to 25 acres in size.

Included with this soil in mapping were many areas of shaly Chenango and Palmyra soils.

This Howard soil is suited to crops, pasture, and trees, and it is suited to those crops that commonly grow in the county. Most areas, however, are used for dairy farming or are idle. Capability unit IIs-2; woodland suitability group 2o2.

Howard shaly silt loam, 8 to 15 percent slopes (HnC).—This soil has a profile similar to the one described as representative for the series, but the coarse fragments are silty shale rather than hard limestone and sandstone. Also, the texture is more silty and less sandy. This moderately sloping soil is on the sides of deltas in valleys in the northern edge of the county. It is in areas where the underlying shaly bedrock was gouged and redeposited as stratified outwash. Individual areas are long and narrow and are 10 to 20 acres in size.

Included with this soil in mapping were many areas of Chenango and Palmyra soils.

This Howard soil is suited to crops, pasture, and trees, and it is suited to those crops that commonly grow in the county. Most areas, however, are used for hay, pasture, or are idle. This soil is in an area of the county where farming is not an important enterprise. Capability unit IIIe-1; woodland suitability group 2o2.

Howard-Madrid gravelly loams, 3 to 8 percent slopes (HoB).—This complex consists of gently sloping or undulating soils on areas of kamy outwash and ablation moraines. Steeper Howard and Madrid gravelly loams generally are adjacent to these soils. This unit is extensive, and individual areas range from 5 to 150 acres in size. Howard and Madrid each make up about half of the complex.

The profile of the Howard soil in this unit is similar to the one described as representative for the Howard series, but it commonly has a thin mantle of gravelly glacial till that contains fewer fragments than the soil formed in glacial outwash. The profile of the Madrid soil in this unit is similar to the one described as representative for the Madrid series, but it generally has a substratum of slightly water-worked ablation material rather than basal till. The gravelly till mantle ranges from less than 1 foot to 6 or 8 feet in thickness over stratified material. The pattern of depth is varied. The thinner mantle is in the Howard soil and the thicker mantle is in the Madrid soil. In places, near side-valley positions, these soils have thick silty layers in the substratum. In these spots cut slopes slump, and the soil is subject to differential frost heaving.

The areas of this complex can be used for early season crops, such as potatoes and peas. Cash-grain crops and dairy crops can be grown. Deep-rooted legumes grow very well because the lower part of the subsoil contains large amounts of lime. Stone fragments interfere with mechanical harvesting of potatoes. In places, during extended dry periods, plants suffer from lack of moisture. Capability unit IIs-2; woodland suitability group 2o2.

Howard-Madrid gravelly loams, 8 to 15 percent slopes (HoC).—This complex consists of moderately sloping soils in areas of kamy outwash and ablation moraines. The landforms are typically a series of knolls that slope in various directions. Some areas of this complex are also on the side slopes of larger terraces. This is the most extensive Howard-Madrid complex. Individual areas range from 5 to more than 100 acres in size. These larger areas are contiguous, but they have other soils mapped within them. About 60 percent of the complex is Howard soil, and about 40 percent is Madrid soil.

The Howard soil in this complex has a profile similar to that described as representative for the Howard series, but in some profiles the upper part of the subsoil contains less coarse fragments and more silt. The Madrid soil in this complex has a profile similar to the one described as representative for the Madrid series, but the substratum generally is slightly water-worked ablation material rather

than basal till. The till mantle is over stratified material in places, and thickness ranges from less than 1 foot to as much as 6 to 8 feet. The pattern of thickness varies. In places, near side-valley positions, these soils have thick silty layers in the substratum. In these areas cut slopes slump, and the soil is subject to differential frost heave.

The areas of this complex are suitable for legume crops because of the reserve lime in the lower part of the subsoil. The irregular slopes limit contour tillage for most areas of this unit. A few wet spots included in mapping need drainage. Row crops can be grown but should be kept to a minimum in the cropping sequence. Frequent applications of fertilizer and use of cover crops allow more intensive use. The soils in this complex are more droughty than those in the less sloping Howard-Madrid complexes. Capability unit IIIe–1; woodland suitability group 2o2.

Howard-Madrid gravelly loams, 15 to 25 percent slopes (HoD).—This complex consists of moderately steep and hilly soils. Areas of moderately steep soil have simple slopes in one direction, but areas of hilly soil are in a series of large kame knolls where slope is in many directions. Individual areas range from 10 to 60 acres in size. The complex is 65 percent Howard soil and 35 percent Madrid soil.

The profile of the Howard soil is similar to the one described as representative for the Howard series, but in places the upper part of the subsoil contains fewer coarse fragments and more silt. The profile of the Madrid soil is similar to that described as representative for the Madrid series, but this Madrid soil generally is underlain by stratified gravel rather than basal till. A gravelly till mantle that ranges from less than 1 foot to about 6 feet in thickness covers this unit in a very erratic pattern. In places near side-valley positions these soils have silty layers in the substratum. In these areas cut slopes slump, and the soil is subject to differential frost heaving.

The moderately steep soils of this complex are susceptible to erosion and are difficult and hazardous to cultivate. Hay and small grains are commonly grown. Deep-rooted legumes grow very well. Capability unit IVe–1; woodland suitability group 2r3.

Howard-Madrid shaly silt loams, 3 to 8 percent slopes (HrB).—This complex consists of gently sloping or undulating soils on deltas in the northwestern part of the county. A mantle of shaly glacial till that ranges from 1 to 8 feet in thickness covers deposits of stratified shaly outwash. Individual areas range from 15 to 40 acres in size. This complex is about evenly divided between Howard and Madrid soils.

The Howard and Madrid soils in this complex each have a profile similar to the one described as representative for their respective series, but these soils contain shale fragments rather than hard mixed fragments and contain slightly more clay. Also, the Madrid soil is underlain by stratified shaly outwash material rather than basal till.

Included with this complex in mapping were areas of Langford soils. In these areas drainage and permeability are impeded.

The areas of this complex are suited to crops, pasture, or trees. Crops used in dairying are commonly grown. Moisture relationships generally are more favorable in these soils than in typical Howard soils. The hazard of erosion is slight if these soils are cultivated and not protected. Capability unit IIs–2; woodland suitability group 2o2.

Howard-Madrid shaly silt loams, 8 to 15 percent slopes (HrC).—This complex consists of moderately sloping soils on long eskers and kettle-kame areas. An example of an esker is just west of Geise Road north of State Route 354. The kettle-kame areas are near Cayuga Creek near Bennington. A mantle of shaly glacial till, ranging in thickness from 1 to 6 feet, covers deposits of stratified shaly outwash. Individual areas are about 25 acres in size. The Howard soil makes up about 60 percent of the complex and the Madrid soil about 40 percent.

The Howard and Madrid soils in this complex each have a profile similar to the one described as representative for their respective series, but these soils contain shale fragments rather than hard mixed fragments and contain slightly more clay. Also, the Madrid soil is underlain by stratified shaly outwash material rather than basal till.

The areas of this unit are suited to crops, pasture, or trees. Many crops used in dairy operations are commonly grown, but increasing amounts of this complex are left idle. Erosion is a hazard if these soils are cultivated and not protected. Capability unit IIIe–1; woodland suitability group 2o2.

Howard-Madrid shaly silt loams, 15 to 25 percent slopes (HrD).—This complex consists of moderately steep soils on lateral moraine deposits along the sides of the major valleys in the northern part of the county. A mantle of shaly glacial till that ranges from 1 to 5 feet in thickness covers deposits of stratified shaly outwash. Howard soil makes up about 70 percent of the complex, and Madrid soil about 30 percent. Individual areas are about 20 acres in size.

The Howard and Madrid soils each have a profile similar to the one described as representative for their respective series, but the Howard and Madrid soils in this complex contain mainly shale fragments rather than limestone or sandstone. Also, the Madrid soil is underlain by stratified gravel rather than basal till.

The areas of this complex are limited for use for crops by slope and the hazard of erosion. Some hay crops and pasture are grown, but large areas are idle or wooded. Use of farm equipment is difficult and dangerous. Capability unit IVe–1; woodland suitability group 2r3.

Howard and Chenango soils, 25 to 40 percent slopes (HsE).—This mapping unit consists of steep Howard and Chenango soils. Either or both of these soils are present in a mapped area. Both of these soils have profiles that are similar to the profile described as representative for their respective series, but the surface layer of these soils generally has never been plowed or is very thin and light colored. These steep soils are on the sides of deltas and terraces, such as those in the southern part of Letchworth Park, or on hilly areas, such as those near Attica and Java.

Included with these soils in mapping were areas of soils that have more sandy or silty layers than shown in the representative profile. Also included were some areas of these steep soils that are underlain by lacustrine silty or clayey deposits. In these areas the entire side slopes have slipped in places, and a few large soil masses show a slip face.

The steep soils of this unit are better suited to trees than to most other uses. In places areas of lesser sloping soils are suited to pasture, but the soils are very droughty, so

growth generally is poor. Capability unit VIe-1; woodland suitability group 2r3.

Ilion Series

The Ilion series is made up of deep, poorly drained, medium-textured soils that have a moderately fine textured subsoil. These nearly level soils formed in glacial till derived mainly from calcareous shale. They are in till landscapes of the plateau, mainly in the northwestern part of the county and, to a lesser extent, in the north-central and southern parts.

In a representative profile the surface layer is 9 inches of very dark gray silt loam that contains a few coarse fragments. The subsurface layer is friable, light-gray to gray silt loam, about 5 inches thick. It contains some coarse fragments and it has distinct mottles. The subsoil, below a depth of 14 inches, is firm, dark grayish-brown light silty clay loam that extends to a depth of 33 inches. It contains a few coarse fragments, and mottles are more numerous than the subsurface layer. The substratum, to a depth of 50 inches or more, is very dark grayish-brown shaly heavy silt loam that has many distinct mottles and contains a large amount of shale.

Ilion soils have free water at or near the surface in spring and after rainy periods unless artificially drained. Permeability is slow. Rooting depth is restricted by the high water table and generally is at a depth of 6 inches in spring and about 15 inches in summer. These soils can supply medium to high amounts of nutrients. The subsoil and substratum contain large supplies of lime, but in places the surface layer needs lime.

Representative profile of Ilion silt loam in a cultivated field in the town of Bennington, 2½ miles east of Bennington Center on State Route 354:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam; moderate, fine and medium, granular structure; friable; many fine roots; 5 to 10 percent coarse fragments; neutral; abrupt, smooth boundary.

A2g—9 to 14 inches, light-gray to gray (10YR 6/1) silt loam; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; very weak, fine, subangular blocky structure; friable; few fine roots; common fine pores; 5 to 10 percent coarse fragments; neutral; clear, wavy boundary.

B21tg—14 to 23 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam; dark-gray (5Y 4/1) ped surfaces; many, medium, distinct, yellowish-brown (10YR 5/4) and common, faint, olive-gray (5Y 4/2) mottles; moderate, medium, subangular blocky structure; firm; few fine roots in upper part; clay films in most pores, patchy on ped faces; 10 percent shale fragments; neutral; clear, smooth boundary.

B22tg—23 to 33 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium and coarse, subangular blocky structure; firm, slightly plastic; few fine pores; thin clay films on most ped faces and lining pores; 10 percent shale fragments; mildly alkaline; gradual, smooth boundary.

Cg—33 to 50 inches very dark grayish-brown (2.5Y 3/2) shaly heavy silt loam; many, medium, distinct, olive (5Y 4/4) and light olive-brown (2.5Y 5/6) streaked mottles; weak, thick, platy structure; firm; few fine pores; 15 to 20 percent shale fragments; calcareous; moderately alkaline.

The solum ranges from 25 to 40 inches in thickness. Carbonates are at a depth of 30 to 50 inches. Bedrock, mainly soft shale, is at a depth of 40 inches to 20 feet or more. Content of coarse fragments ranges from 0 to 15 percent, by volume, in the upper part of the solum and from 10 to 25 percent, by volume, in the lower part of the solum and in the C horizon. The solum ranges from slightly acid to neutral in the upper part and from neutral to mildly alkaline in the lower part. Hue ranges from 10YR to 5Y.

The Ap horizon has a value of 2 or 3 when moist and 4 or 5 when dry. Chroma is 1 or 2. The A2 horizon has a value of 4 to 6 and a chroma of 1 or 2. It ranges from loam to heavy silt loam.

The B horizon has a value of 4 or 5 and a chroma of 1 or 2. Mottles are mainly of higher chroma, are faint to distinct, and are common to many.

The C horizon has platy structure or is massive.

Ilion soils formed in material similar to that of the very poorly drained Alden soils and the somewhat poorly drained Darien and Fremont soils. They are less acid than Fremont soils. Ilion soils are also near Ellery and Sun soils in places and occupy similar positions on the landscape. They have a finer textured B horizon than Ellery and Sun soils and lack the fragipan that is in Ellery soils. In places Ilion soils are near somewhat poorly drained to moderately well drained Hornell soils. Ilion soils have a coarser textured B horizon than Hornell soils. They are much less acid and are more than 40 inches deep over shale bedrock.

Ilion silt loam (In).—This is the only Ilion soil mapped in the county. It is nearly level and is in areas surrounded mostly by sloping soils from which it receives considerable amounts of runoff. Most individual areas range from 5 to 20 acres in size and generally are oblong or circular. Larger areas are long and narrow and are along drainageways.

Included with this soil in mapping were spots of better drained Darien and Hornell soils in the northern part of the county. Also included were areas of drier and more acid Fremont soil in the southern part of the county. Areas similar to Ellery soils and isolated areas that have shale bedrock at a depth of 3 feet were also included. Very poorly drained pockets of Alden soils were minor inclusions.

This Ilion soil is suited mainly to pasture and woodland and well suited to wildlife marshes if not drained. Capability unit IVw-2; woodland suitability group 4w2.

Langford Series

The Langford series consists of deep, moderately well drained to well drained, medium-textured soils that formed in low-lime glacial till. These soils have a well-expressed fragipan at a depth of about 15 to 24 inches. In places reaction is strongly acid in the upper part, but it is neutral within a depth of 40 inches. These soils are nearly level to moderately steep. Areas are on uplands and are in all but the extreme northern part of the county.

In a representative profile the surface layer is dark grayish-brown channery silt loam 9 inches thick. The upper part of the subsoil, to a depth of 16 inches, is friable, medium-acid, yellowish-brown channery silt loam. From a depth of 16 down to 20 inches is a friable, medium-acid, light brownish-gray, channery loam, leached layer that is distinctly mottled. The lower part of the subsoil, from a depth of 20 down to 48 inches, is a dense, slowly permeable fragipan. The upper part of this fragipan, from a depth of 20 down to 30 inches, is slightly acid, firm and brittle, olive-brown channery silt loam that is distinctly mottled. The lower part of the fragipan is firm and brittle, neutral, dark grayish-brown channery silt loam that has faint mottles. From a depth of 48 down to 55 inches or more, the substratum is very firm, grayish-brown channery silt loam that is weakly calcareous. The content of coarse fragments

increases from about 30 percent in the upper part of the fragipan to 40 percent in the substratum.

In Langford soils rooting depth is limited largely to the zone above the fragipan. Available water capacity is low to moderate. Permeability is moderate in the surface layer and the upper part of the subsoil and slow or very slow in the fragipan. Natural fertility is medium. Lime needs are high.

Representative profile of Langford channery silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Wethersfield, 30 feet north of Hobday Road, one-eighth mile west of Gainesville-Wethersfield town line:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, fine and medium, granular structure; very friable; many fine roots; 20 percent coarse fragments; slightly acid; abrupt, smooth boundary.

B2—9 to 16 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, medium, subangular blocky structure; friable; common fine roots; 20 percent coarse fragments; medium acid; clear, wavy boundary.

A'2—16 to 20 inches, light brownish-gray (2.5Y 6/2) channery loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles along the border of the Bx horizon; weak, medium, platy structure; friable; few roots; 25 percent coarse fragments; medium acid; abrupt, irregular boundary.

B'x1—20 to 30 inches, olive-brown (2.5Y 4/4) channery silt loam; few, medium, faint, dark grayish-brown (10YR 4/2) and distinct yellowish-brown (10YR 5/6) mottles; moderate, very coarse, prismatic structure parting to very weak, medium, subangular blocky; prisms coated with tongues of light brownish-gray (2.5Y 6/2) loam that has distinct strong-brown mottles or bands; firm and brittle; few roots along surface of prism; clay in pores; 30 percent coarse fragments; slightly acid; gradual, smooth boundary.

B'x2—30 to 48 inches, dark grayish-brown (2.5Y 4/2) channery silt loam; common, fine, faint, olive-brown (2.5Y 4/4) mottles; massive or very weak, coarse, blocky structure; firm and brittle; clay films in few discontinuous ⅛- to ¼-inch cracks within matrix and in pores; 40 percent coarse fragments; neutral; gradual, wavy boundary.

C—48 to 55 inches, grayish-brown (2.5Y 5/2) channery silt loam; weak, thick, platy structure to massive; very firm; 40 percent coarse fragments; weakly calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness and corresponds to the depth to carbonates. Depth to bedrock ranges from 40 inches to many feet. Depth to the fragipan ranges from 15 to 24 inches. Content of coarse fragments ranges from 10 to 20 percent in the horizons above the fragipan and from 20 to 60 percent in the fragipan and C horizon. The fragments include channers, flagstones, pebbles, and stones. They are commonly mixed with shale in various types of profiles.

The Ap horizon has a hue of 2.5Y to 10YR, a value of 3 to 5, and a chroma of 2.

The B2 horizon extends to a depth of 12 inches or more. It has a hue of 2.5Y to 7.5YR, a value of 4 or 5, and a chroma of 3 to 6. It ranges from silt loam to loam and from medium acid to strongly acid.

The A'2 horizon has a hue of 2.5Y to 10YR, a value of 5 to 6, and a chroma of 2 to 4. It ranges from fine sandy loam to light silt loam. Texture typically is noticeably coarser than that of the B'x horizon.

The fragipan has a hue of 2.5Y to 10YR, a value of 4 to 5, and a chroma of 2 to 4. Mottles are few to common and faint except for high-chroma mottles or bands in tongues between prisms. The fragipan ranges from loam to heavy silt loam. Clay films are present in all pores, but they are typically absent on prism faces or on distinct blocky aggregates. The fragipan is firm to extremely firm. It is neutral to strongly acid in the upper part and neutral in the lower part.

Langford soils are associated in a drainage sequence with the poorly drained Ellery soils and somewhat poorly drained Erie soils. They occupy positions on the landscape similar to those of Bath, Canaseraga, Conesus, Lansing, and Mardin soils. Langford soils are less acid than Bath and Madrid soils. They lack the thick silt mantle that is present in similar Canaseraga soils. Langford soils have a fragipan which is lacking in the Conesus and Lansing soils, and they are more acid than these soils.

Langford channery silt loam, 0 to 3 percent slopes (LaA).—This soil is nearly level and commonly has convex slopes where runoff is somewhat retarded. Drainage is not so good as on the more sloping Langford soils. The individual areas are large and range from 20 to 100 acres in size. They are irregular in shape.

Included with this soil in mapping were spots of Canaseraga, Erie, and Mardin soils. The Erie soils are similar, but wetter. They are in narrow strips along drainageways and in slight depressional areas. The Mardin soils are on similar landscapes but are more acid in the fragipan. Canaseraga soils have thick silt deposits capping the glacial till.

This Langford soil is suited to most crops, pasture, or trees. Small grains and silage corn are commonly grown. Planting early in spring is delayed because of temporary wetness. The seasonal high water table and slowly permeable fragipan are the main limitations to use for crops. Capability unit IIw-2; woodland suitability group 3o1.

Langford channery silt loam, 3 to 8 percent slopes (LaB).—This soil has the profile described as representative for the series. It is extensive, and areas of this soil make up 50 percent of the total acreage of Langford soils. This soil is gently sloping and commonly has convex or smooth slopes that, in places, receive some runoff from adjacent soils. Individual areas are long and broad. Slopes are mostly in one direction. These areas range from 10 to 100 acres in size.

Included with this soil in mapping were small areas of wetter Erie soils in depressions and along drainageways. Also included were spots of Mardin soils that occupy similar positions but are more acid in the subsoil. Small areas of Canaseraga soils were included on similar valley-side positions. They are acid soils but are characterized by a thick silt mantle capping the glacial till.

This Langford soil is suited to many general crops, pasture, or trees. It is used extensively for silage corn, small grains, and hay. In places planting is delayed a few days in spring because of wetness. Erosion is a hazard in places if no protective measures are practiced. Capability unit IIw-3; woodland suitability group 3o1.

Langford channery silt loam, 8 to 15 percent slopes (LaC).—This soil has a profile similar to the one described as representative for the series, but it is moderately sloping, and slopes generally are in one direction. It receives runoff from adjacent higher areas. In areas where the soil is eroded, most of the yellowish-brown upper part of the subsoil has been incorporated into the plow layer.

Included with this soil in mapping were areas of Bath, Canaseraga, and Mardin soils. The upper part of the subsoil is thicker in the Bath soils, and they are coarser in texture. Mardin soils are more acid in the subsoil. Canaseraga soils have a thick silt mantle. Also included were areas of wetter and heavier Fremont soils in the south-central part of the county.

This Langford soil is not well suited to intensive cultivation. If properly managed, this soil can be used successfully for row crops, but it is better suited to hay,

pasture, or woodland. Runoff is rapid, and the hazard of erosion is serious. Capability unit IIIe-5; woodland suitability group 3o1.

Langford channery silt loam, 15 to 25 percent slopes (LaD).—This soil has a profile similar to the one described as representative for the series, but it generally is drier, and in places erosion has caused the depth to the fragipan to be shallower. This soil is moderately steep. Gully erosion is characteristic of the landscape on which this soil occurs. Individual areas occur as long narrow strips along ridges and valley walls.

Included with this soil in mapping were areas of Bath and Mardin soils. The upper part of the subsoil of the Bath soils is thicker, and they are coarser textured. Mardin soils are similar in drainage and texture to this Langford soil but are more acid in the fragipan.

This Langford soil can be used for crops only with great difficulty because it is moderately steep. Much of it is used for hay or permanent pasture. Many areas are wooded, and some are idle. Runoff is rapid, and erosion is a serious hazard. Capability unit IVe-4; woodland suitability group 3r1.

Lansing Series

The Lansing series is made up of deep, well-drained, medium-textured soils that formed in calcareous glacial till that consists mainly of mixed limestone, shale, and sandstone. These soils are gently sloping to steep and commonly have convex slopes. They receive little or no runoff from adjacent soils. Lansing soils are mainly in the northeastern part of the county.

In a representative profile the surface layer is dark grayish-brown gravelly silt loam 8 inches thick. The subsurface layer is pale-brown, friable gravelly silt loam 5 inches thick. Material from this layer interfingers into the upper part of the subsoil at a depth of about 13 inches. The upper part of the subsoil is brown, friable gravelly silt loam. The lower part of the subsoil is brown to dark-brown, firm gravelly silt loam about 18 inches thick. It has a slightly higher content of clay than the upper part. Below a depth of 39 inches, the substratum is calcareous, firm, dark grayish-brown gravelly loam that extends to a depth of more than 50 inches.

In Lansing soils, rooting depth is 30 inches or more in places. The available water capacity is high. Permeability is moderate in the surface layer and subsoil and slow or very slow in the substratum. Natural fertility is medium to high. Lansing soils have medium-lime profiles. Where slope permits, these soils are well suited to most crops grown in the county.

Representative profile of Lansing gravelly silt loam, 2 to 8 percent slopes, in a cultivated field in the town of Covington, 2 miles south of the village of Pavilion and one-half mile west of State Route 246 on Court Road:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; weak to moderate, fine, granular structure; very friable; many fine roots; 15 percent coarse fragments; medium acid; abrupt, smooth boundary.

A2—8 to 13 inches, pale-brown (10YR 6/3) gravelly silt loam; weak, medium, platy structure; friable; common fine roots; many pores; 15 percent coarse fragments; medium acid; clear, wavy boundary.

B&A—13 to 21 inches, brown (10YR 5/3) gravelly silt loam; weak to moderate, medium, subangular blocky structure; friable; common roots; many pores; prominent interfingering of pale-brown (10YR 6/3) silt surrounds peds; thin clay films in pores in ped interiors; 15 percent coarse fragments; medium acid; clear, wavy boundary.

B21t—21 to 28 inches, brown to dark-brown (10YR 4/3) gravelly silt loam; moderate, medium, subangular blocky structure; firm; few roots; common pores; clay films in pores and on some ped surfaces; 15 percent coarse fragments; slightly acid; gradual, wavy boundary.

B22t—28 to 39 inches, dark-brown to brown (10YR 4/3) gravelly silt loam; moderate, medium and coarse, subangular blocky structure; firm; common pores; clay films in pores and common on ped faces; 20 percent coarse fragmnets; neutral; clear, wavy boundary.

C—39 to 50 inches, dark grayish-brown (2.5Y 4/2) gravelly loam; moderate, medium, platy structure; firm; 30 to 40 percent mixed fragments; calcareous; moderately alkaline.

The solum ranges from 32 to 48 inches in thickness. Depth to bedrock ranges from 40 inches to 20 feet or more. The content of coarse fragments, by volume, ranges from 5 to 20 percent in the solum and from 10 to 30 percent in the substratum. Coarse fragments generally are gravelly, but some tend to be angular. Carbonates are at a depth of 36 to 50 inches. Reaction ranges from strongly acid to medium acid in the upper part of the solum and from slightly acid to neutral in the lower part.

The Ap horizon has a dominant hue of 10YR, a value of 3 or 4, and a chroma of 2 or 3.

The A2 horizon has a hue of 10YR, a value of 5 or 6, and a chroma of 3 or 4. This horizon is loam or silt loam.

The B&A horizon is similar in color and texture to adjacent horizons.

The B2t horizon has a hue of 10YR or 2.5Y, a value of 4 or 5, and a chroma of 3 or 4. It is silt loam or loam. A few high-chroma mottles are in the lower part of the B2t horizon in some profiles.

The C horizon is similar in color to the B2t horizon, except that chroma generally is lower. This horizon is mainly loam, but it is lower in content of clay than the Bt horizon.

Lansing soils are in a drainage sequence with the somewhat poorly drained Appleton soils and the moderately well drained Conesus soils that formed in similar material. These soils occupy landscapes similar to those of Langford, Madrid, and Nunda soils. They lack the fragipan of the Langford soils. They have a finer textured B horizon than Madrid soils. They lack the thick silty or loamy mantle of Nunda soils.

Lansing gravelly silt loam, 2 to 8 percent slopes (LgB).—This gently sloping soil has the profile described as representative for the series. It is mainly in convex areas, generally on the tops of drumlins. These areas are mainly in the northeastern part of the county. Individual areas are commonly oblong and are oriented in a north-to-south direction.

Included with this soil in mapping were spots of moderately well drained Conesus soils that formed in similar material; moderately well drained, slightly finer textured Nunda soils; and coarser textured Madrid soils. Also included were small nongravelly areas, eroded areas, and wet spots.

Most areas of this Lansing soil are cleared and are intensively cultivated. The soil is used mainly for hay, grain, and dry beans. This soil responds well to applications of fertilizer and lime. The gravel-size coarse fragments do not interfere with most farm operations. Erosion is a slight to moderate hazard, especially on long slopes. Capability unit IIe-1; woodland suitability group 2o2.

Lansing gravelly silt loam, 8 to 15 percent slopes (LgC).—This soil has a profile similar to the one described as representative for the series, but in places the surface layer is thinner, contains less organic matter, and contains a higher percentage of gravel-size fragments. It is moder-

ately sloping and mainly is on the sides of drumlins. These drumlins are mainly in the northeastern part of the county. Individual areas are commonly oblong and are oriented in a north-to-south direction. Some areas occur as thin strips around two or more sides of a drumlin.

Included with this soil in mapping were areas of moderately well drained Conesus soils that formed in similar material; moderately well drained, slightly finer textured Nunda soils; and coarser textured Madrid soils. Also included were small nongravelly areas, eroded areas, and wet spots.

Most areas of this Lansing soil are cleared and used for corn, hay, grain, and dry beans. Crops respond well to applications of fertilizer and lime. The gravel-size coarse fragments do not interfere with most farm operations. Erosion is a moderate to severe hazard, especially where slopes are long. Capability unit IIIe-1; woodland suitability group 2o2.

Lansing gravelly silt loam, 15 to 25 percent slopes (LgD).—This moderately steep soil has a profile similar to the one described as representative for the series, but the subsurface layer generally is thinner. It is in the same general area as other Lansing soils and generally is on the more sloping parts of drumlins. Individual areas are oblong or occur as narrow strips around two or more sides of a drumlin.

Included with this soil in mapping were areas of coarser textured Madrid soils and finer textured Nunda soils. Also included were small areas of nongravelly soils, small areas of eroded soils, and wet spots.

Most areas of this Lansing soil are used for grain, hay crops, or pasture. The moderately steep soils are difficult and hazardous to work using heavy equipment. Runoff from this soil is rapid to very rapid during high intensity rainstorms. It is susceptible to severe erosion if it is not properly managed. Capability unit IVe-1; woodland suitability group 2r3.

Lansing gravelly silt loam, 25 to 40 percent slopes (LgE).—This steep soil has a profile similar to the one described as representative for the series, but the upper layer of the soil generally is somewhat thinner. It is on the steepest parts of drumlins in the northeastern part of the county. Individual areas are oblong or occur as narrow strips on steep sides of drumlins.

Included with this soil in mapping were areas of Madrid soils and finer textured Nunda soils. Also included were a few areas of soils that have slopes of more than 40 percent and small areas of soils that are shallow and moderately deep to bedrock. Small areas of nongravelly soils, small areas of eroded soils, and wet spots were also included.

Most areas of this Lansing soil are used for pasture or are wooded. Runoff generally is very rapid, especially during high intensity rainstorms. Erosion is a serious concern. Disturbing the vegetative cover or close grazing should be avoided if possible. Because of slope and the hazard of erosion, this soil has severe limitations for both farming and community use. Capability unit VIe-1; woodland suitability group 2r3.

Lordstown Series

The Lordstown series is made up of moderately deep, well-drained, medium-textured soils that formed in strongly acid till dominated by sandstone. These soils are gently sloping to very steep and are along valley sides and in uplands. The areas are mainly in an area extending from the town of Bennington through the town of Attica to the southern part of the town of Warsaw.

In a representative profile the surface layer is dark grayish-brown channery silt loam about 7 inches thick. The upper part of the subsoil is yellowish-brown channery silt loam from a depth of 7 down to 15 inches. This layer is friable and strongly acid. The lower part of the subsoil, from a depth of 15 down to 28 inches, is friable, brown very channery loam that is strongly acid. Hard, grayish-brown sandstone bedrock is at a depth of 28 inches.

In Lordstown soils rooting depth is 20 to 40 inches, all of the zone above the bedrock. Available water capacity is low to moderate. Droughtiness is a limitation in places during very dry years. Permeability is moderate. The plow layer is porous and is excellent for growth of plant roots. The soil is strongly acid. Coarse fragments limit tillage and harvest operations in places. Natural fertility is medium.

Representative profile of Lordstown channery silt loam, 2 to 8 percent slopes, in a cultivated field in the town of Attica, 4 miles south of the village of Attica on Merle Road, one-half mile east of junction with Austin Road:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, fine, granular structure; very friable; many fine roots; 30 percent coarse fragments; strongly acid; abrupt, smooth boundary.

B21—7 to 15 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, fine, subangular blocky structure; friable; few fine roots; many fine pores; 35 percent coarse fragments; strongly acid; clear, wavy boundary.

B22—15 to 28 inches, brown (10YR 5/3) very channery loam; weak, fine, subangular blocky structure; friable; few fine roots; common fine pores; 45 percent coarse fragments; strongly acid; abrupt, smooth boundary.

R—28 inches +, hard, grayish-brown sandstone bedrock.

The solum ranges from 20 to 40 inches in thickness. It generally rests directly on bedrock, but in places a thin C horizon that consists of fine earth mixed with loose, shattered rock is present. Coarse fragments are dominantly flat angular flagstones and fragments. The solum is strongly acid throughout. Hue is mainly 10YR.

The Ap horizon has a value of 3 to 5 and a chroma mainly of 2.

The B horizon has a value of 4 or 5 and a chroma of 3 to 6. This horizon is loam or silt loam. Content of coarse fragments ranges from 35 to 50 percent. A few high-chroma mottles are in the lower part of the B horizon of some profiles.

The bedrock consists of massive, thick-to-thin beds of sandstone interbedded with shale.

The Lordstown soils are commonly near Arnot, Bath, and Tuller soils that formed in similar material. Lordstown soils are moderately deep to bedrock in contrast to the shallow, well drained to moderately well drained Arnot soils and somewhat poorly drained to poorly drained Tuller soils. Lordstown soils are shallower to bedrock and lack the fragipan of Bath soils. They are similar to Manlius soils, which formed in shaly till.

Lordstown channery silt loam, 2 to 8 percent slopes (LoB).—This soil has the profile described as representative for the series. It is gently sloping and has slightly convex slopes. The areas normally receive little or no runoff from upper adjacent slopes. This soil generally is in uplands and commonly is on the higher slopes adjacent to steeper Lordstown soils along valley sides. Individual areas are irregular in shape and range from 5 to 40 acres or more in size.

Included with this soil in mapping were areas of nearly level soils that have slightly convex slopes. Also included were areas of somewhat poorly drained Tuller soils in slight depressions. The latter are commonly indicated on the soil map by the symbol for wet spots and drainageways. Also included were a few spots of Arnot soils that have bedrock at a depth of less than 20 inches and small areas of deeper Bath soils.

This Lordstown soil is suited to crops, pasture, or woodland. Dairying is the main farming enterprise. Crops, such as corn and oats, grow well. Erosion is a slight hazard if this soil is cultivated and not protected. Capability unit IIe–2; woodland suitability group 3o1.

Lordstown channery silt loam, 8 to 15 percent slopes (LoC).—This moderately sloping soil is on uplands and along upper valley walls. It receives some runoff from adjacent slopes in places. Individual areas along upper valley walls are long and narrow, and other areas vary in shape. Individual areas range from 5 to 40 acres in size. Areas of this soil are not extensive.

Included with this soil in mapping were small areas of shallower Arnot soils. Also included were wetter Tuller soils, mainly along small drainageways.

This Lordstown soil is well suited to pasture and trees. It is used for crops generally associated with dairy operations. Small grain and hay crops grow well if adequate fertilizer and lime are applied. Potatoes have some potential on this soil, but slope and coarse fragments limit harvesting operations in places. Erosion is a hazard. Capability unit IIIe–2; woodland suitability group 3o1.

Lordstown channery silt loam, 15 to 25 percent slopes (LoD).—This modertaely sloping soil is on uplands and representative for the series, but the surface layer and upper part of the subsoil are thinner in places because of erosion. This soil is moderately steep and commonly receives runoff from upper adjacent slopes. It generally is in long narrow areas as part of upper valley walls. Individual areas range from 10 to 50 acres or more in size. Bedrock is exposed where drainageways dissect this soil.

Included with this soil in mapping were areas of shaly Manlius soils. Also included in some areas were areas of soils that have a finer texture.

Much of this Lordstown soil is wooded or idle. Crops can be grown, but the hazard of erosion and the hazards involved in machinery operation are serious limitations. If crops are grown, long-term hay or pasture should be dominant in the cropping system. Capability unit IVe–2; woodland suitability group 3r1.

Lordstown channery silt loam, 25 to 40 percent slopes (LoE).—This soil has a profile similar to the one described as representative for the series, but the surface layer and subsoil generally are thinner. Most areas of this steep soil occur as part of valley walls and reflect the presence of sandstone, the dominant underlying bedrock. Lesser sloping Lordstown soils are adjacent on upper landscapes. Individual areas are long and roughly rectangular. They range from 10 to 70 acres or more in size.

Included with this soil in mapping were areas of very steep soils and exposed bedrock ledges where small drainageways dissect this soil. Slopes of this soil are smooth, but the underlying bedrock is in a series of steps up the valley wall. At the edge of these steps the soil mantle is thinnest, and here spots of Arnot soils were commonly included. Where the soil mantle is thicker, deeper Bath soils were commonly included.

Most of this Lordstown soil is wooded, and cleared areas are idle. This soil is better suited as woodland or to use for recreational areas than to other uses. Steepness and hard bedrock are limitations for all uses. Capability unit VIe–2; woodland suitability group 3r1.

Lyons Series

The Lyons series is made up of deep, poorly drained to very poorly drained, medium-textured soils that formed in calcareous glacial till derived mainly from limestone, shale, and sandstone. These nearly level soils are in depressions on the till landscape in the northeastern part of the county.

In a representative profile, in a cultivated area, the surface layer is very dark gray silt loam 9 inches thick. The upper part of the subsoil is light-gray, friable silt loam that has common distinct mottles. The lower part of the subsoil, from a depth of 13 down to 28 inches, is firm, grayish-brown silt loam that has many distinct mottles. Reaction in this layer is neutral. Below a depth of about 28 inches, the substratum is calcareous, light-brownish gray gravelly loam that is firm and mottled.

Lyons soils have very slow surface drainage and slow internal drainage. In undrained areas the water table is at or near the surface until late in spring. These soils receive considerable amounts of runoff from higher adjacent soils and are commonly ponded in wet periods. In undrained areas rooting depth is normally 12 inches. As the water table drops in summer, some roots go deeper. Permeability is moderate in the solum and slow or very slow in the substratum. Available water capacity depends on rooting depth, but it generally is moderate. Natural nutrient supplying power of these soils is high if adequately drained. Lime needs are low. Crops grow well if these soils are properly drained.

Representative profile of Lyons silt loam, in a cultivated field in the town of Perry, one-third mile east of intersection of State Route 246 and County Road No. 28, 300 feet south of County Road No. 28:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam; weak, medium, granular structure; very friable; many fine roots; 5 percent coarse fragments; slightly acid; abrupt, smooth boundary.

B21g—9 to 13 inches, light-gray (10YR 6/1) silt loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; weak, very fine, subangular blocky structure within thick platy structure; friable; few fine roots; 5 percent coarse fragments; slightly acid; abrupt, wavy boundary.

B22g—13 to 28 inches, grayish-brown (10YR 5/2) silt loam; many, medium, distinct, light-gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; few roots in upper part; 10 percent coarse fragments; neutral; clear, wavy boundary.

C—28 to 50 inches, light brownish-gray (10YR 6/2) gravelly loam; many, fine, distinct, yellowish-brown (10YR 5/4 and 5/6) mottles; moderate, medium, platy structure; firm; 20 percent coarse fragments; calcareous; moderately alkaline.

The solum ranges from 20 to 36 inches in thickness and corresponds to the depth to carbonates. The upper horizons are influenced in places by local alluvium that ranges from 0 to 15 inches in thickness. Bedrock is at a depth of 3½ to 30 feet or more. The content of coarse fragments ranges from

5 to 20 percent in the solum. Hue ranges from 7.5YR to 2.5Y. The solum ranges from slightly acid to neutral.

The Ap or A1 horizon has a value of 2 or 3 and a chroma of 1 or 2.

The B horizon has a value of 4 to 6 and a chroma of 1 or 2. It has common, distinct mottles that have a chroma of 3 to 6. Individual subhorizons range from sandy loam to silty clay loam.

The C horizon generally is calcareous gravelly loam that is about 15 to 30 percent coarse fragments.

Lyons soils are associated with the drier Appleton, Conesus, and Lansing soils that formed in similar material. They are also near somewhat poorly drained Burdett soils that formed in a silty or loamy mantle underlain by shaly till. These soils are similar to and occupy the same kinds of landscapes as the Ellery, Ilion, and Sun soils. They lack the fragipan of Ellery soils and are shallower to carbonates than these soils. They have a coarser textured B horizon than Ilion soils and a finer textured B horizon than Sun soils.

Lyons silt loam (Ly).—This is the only Lyons soil mapped in the county. It is nearly level or in concave depressions on undulating to rolling till plains. Considerable amounts of runoff from adjacent drier soils accumulate within these areas, and the soil is ponded for long periods in places. Individual areas range from 10 to 20 acres in size and generally are oblong. A few areas occur as long narrow strips along drainageways within areas of better drained soils.

Included with this soil in mapping were areas of better drained Appleton, Burdett, and Conesus soils on slight rises or knolls. Also included were small areas of soils that have a mucky surface layer and are darker colored than typical Lyons soils.

This Lyons soil is of little importance for crops. It is suited mainly to pasture or trees. If adequately drained, however, this soil is suited to general row crops, including cash crops. Lyons soils are well suited to wildlife marshes. Capability unit IVw-2; woodland suitability group 4w2.

Madrid Series

The Madrid series is made up of deep, well-drained, medium-textured and moderately coarse textured soils that formed in glacial till derived mainly from sandstone, shale, and limestone. The till deposits consist of firm basal till in some areas and ablation till that shows evidence of some water working in others. These soils are gently sloping or moderately sloping where they are in smooth areas of the landscape in the basal till areas, and they are gently sloping to moderately steep where they are in irregularly sloping areas of the landscape in the ablation till areas. Glacial outwash deposits commonly are intermingled in the ablation areas, and they commonly underlie the till deposits. The smooth glacial till area is in the eastern part of the county. The hummocky till intermingled with outwash material is extensive and is in the south-central part.

In a representative profile, in a wooded area, the surface layer is very dark grayish-brown loam about 4 inches thick. In plowed areas, the color is lighter and ranges to dark grayish brown. The plow layer is about 10 inches thick. Strongly acid, friable subsurface layers extend to a depth of about 34 inches. The upper one, which extends to a depth of about 19 inches, is yellowish-brown loam. The lower one, which is at a depth of about 19 inches and extends to a depth of 34 inches, is pale-brown very fine sandy loam that surrounds small lumps of brown loam. The upper part of the subsoil, from a depth of 34 down to 47 inches, is a transitional layer between the subsurface layer and the lower part of the subsoil, which contains more clay. It consists of lumps of dark yellowish-brown loam separated by wedges of pale-brown very fine sandy loam. It is friable and medium acid. A few gravelly fragments are in the surface and subsurface layers and in the upper part of the subsoil. The lower part of the subsoil, from a depth of 47 down to 59 inches, is brown to dark-brown, firm gravelly loam. From a depth of 59 down to 75 inches or more, the substratum is firm, dark grayish-brown, gravelly loam or very fine sandy loam till that is weakly calcareous.

Madrid soils dry out quickly after rain, and rooting depth is 30 inches or more. Natural fertility is low, but crops respond well to lime and fertilizer. Roots of deep-rooted legumes will reach the lime in the substratum. Available water capacity is moderate to high. Permeability is moderate in the solum and dominantly moderately slow or slow in the substratum. In places where sandy pockets are encountered, permeability is rapid.

Representative profile of Madrid loam, 8 to 15 percent slopes, in a wooded area in the town of Perry, 3 miles northeast of Perry Center, on Burke Hill Road, County Road No. 28, 1/4 mile west of intersection with Simmons Road:

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) loam, light brownish gray (10YR 6/2) crushed and dry; moderate, medium, granular structure; friable, many fine and medium roots; 10 percent coarse fragments; strongly acid; clear, smooth boundary.

A2—4 to 19 inches, yellowish-brown (10YR 5/4) loam; weak, fine and medium, granular structure; friable; common medium and fine roots; many fine pores; 8 percent coarse fragments; strongly acid; clear, wavy boundary.

A&B—19 to 34 inches, pale-brown (10YR 6/3) very fine sandy loam in the 3/4 of the layer that completely surrounds peds of brown (7.5YR 4/4) loam; weak, thin, platy structure to subangular blocky in loam pockets; friable; common fine and medium roots in upper part, few fine and medium roots in lower part; many fine pores; 5 to 10 percent coarse fragments; strongly acid; gradual, wavy boundary.

B&A—34 to 47 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, subangular blocky structure; friable; few fine roots; many fine pores; peds separated by wedges, 1/4 to 1 inch thick, of pale-brown (10YR 6/3) very fine sandy loam; thin clay films in places in pores of ped interiors; 10 percent coarse fragments; medium acid; gradual, wavy boundary.

B2t—47 to 59 inches, brown to dark-brown (10YR 4/3) gravelly loam; moderate, medium, subangular blocky structure; firm; clay films in most pores and on 15 percent of ped faces; 15 percent gravel; slightly acid to neutral; clear, wavy boundary.

C—59 to 75 inches, dark grayish-brown (2.5Y 4/2) gravelly loam or very fine sandy loam; weak, thin, platy structure; firm; 20 percent coarse fragments; weakly calcareous; moderately alkaline.

The solum ranges from 36 to 60 inches in thickness. Carbonates are at a depth of 3½ to 6 feet. The content of coarse fragments ranges from 5 to 25 percent. Bedrock is at a depth of 6 to 30 feet. Hue ranges from 7.5YR to 2.5Y.

The A1 and A2 horizons range from silt loam to fine sandy loam. The A2 horizon has a value of 4 to 6 and a chroma of 3 to 6. Reaction ranges from neutral to strongly acid.

The color and texture of the A part of the A&B and B&A horizons are similar to those of the A horizon; the color and texture of the B part are similar to those of the B horizon.

The B2t horizon has a value of 3 to 5 and a chroma of 3 or 4. It is loam or fine sandy loam. This horizon has weak or moderate subangular blocky structure. It is neutral to medium acid.

The C horizon has a value of 3 or 4 and a chroma of 2 to 4.

It is mildly alkaline and is weakly calcareous in places. The content of coarse fragments ranges from 10 to 35 percent.

Madrid soils are similar to Howard, Lansing, and Valois soils. These soils lack the very gravelly Bt horizon of Howard soils. They have a coarser textured B horizon and are deeper to carbonates than Lansing soils. Madrid soils are less acid in the lower part of the B horizon than Valois soils. They are near Arkport soils that formed in deep sandy deposits and in places are near Bath soils. Madrid soils lack the fragipan of Bath soils, and they are less acid in the lower part of the subsoil.

Madrid fine sandy loam, 2 to 8 percent slopes (MaB).—This soil has a profile similar to the one described as representative for the series, but the surface layer is fine sandy loam and the subsoil is more sandy in places. Also, this soil is slightly more droughty. It is gently sloping or undulating and has convex slopes. It is on the fringe of the plateau-central plain at the eastern edge of the county. Individual areas are about 25 acres in size.

Included with this soil in mapping were some areas of sandy Arkport soils.

This Madrid soil is used for most of the cash-grain and field crops commonly grown in the county. Deep-rooted legumes grow very well. Erosion is a slight hazard if this soil is cultivated and not protected. Capability unit IIe–1; woodland suitability group 2o2.

Madrid fine sandy loam, 8 to 15 percent slopes (MaC).—This soil has a profile similar to the one described as representative for the series, but the surface layer is fine sandy loam and the subsoil is more sandy in places. Also, it is slightly more droughty and is more erodible. This soil is moderately sloping and is in areas of the plateau-central plain fringe at the eastern edge of the county. Individual areas are about 25 acres in size.

Included with this soil in mapping were areas of sandy Arkport soils.

This Madrid soil is used for most of the cash-grain and field crops commonly grown in the county. Limitations for the use of equipment are moderate. Soil-conserving practices are needed. Capability unit IIIe–1; woodland suitability group 2o2.

Madrid loam, 2 to 8 percent slopes (MdB).—This soil has a profile similar to the one described as representative for the series, but it commonly has a dark grayish-brown plow layer about 10 inches thick. It is gently sloping or undulating and has convex slopes. It is in areas of the plateau-central plain fringe in the northeastern part of the county. It generally is part of drumlinlike landscapes. Individual areas are about 20 acres in size.

Included with this soil in mapping were areas of finer textured Lansing and more acid Bath soils.

This Madrid soil is suited to crops, pasture, and trees. It is used for most of the cash-grain and field crops commonly grown in the county. Deep-rooted legumes grow well. Erosion is a slight hazard if this soil is cultivated and not protected. Capability unit IIe–1; woodland suitability group 2o2.

Madrid loam, 8 to 15 percent slopes (MdC).—This soil has the profile described as representative for the series. Large areas, however, are cultivated and have a dark grayish-brown plow layer. This soil is moderately sloping and is in areas of the plateau-central plain fringe in the northeastern part of the county. It generally is part of drumlinlike landscapes. Individual areas are about 25 acres in size.

Included with this soil in mapping were areas of finer textured Lansing and more acid Bath soils.

This Madrid soil is suited to crops, pasture, and trees. Some row crops are grown, but this soil is in grain and hay crops at least half of the time. Erosion is a moderate hazard if this soil is cultivated and not protected. Use of large harvesting and tillage equipment is difficult on the steeper soils. Capability unit IIIe–1; woodland suitability group 2o2.

Manlius Series

The Manlius series is made up of moderately deep, well-drained to excessively drained, medium-textured soils that formed in acid glacial till derived mainly from black brittle shale. These soils are nearly level to very steep and are in areas in the north-central and northwestern part of the county.

In a representative profile the surface layer is very dark grayish brown shaly silt loam 7 inches thick. The upper part of the subsoil, from a depth of 7 down to 14 inches, is friable, yellowish-brown very shaly silt loam. From a depth of 14 down to 22 inches, the lower part of the subsoil is friable, dark yellowish-brown very shaly silt loam. The substratum, to a depth of 30 inches, is dark grayish-brown to dark-brown very shaly loam that is slightly firm. Reaction is strongly acid throughout. The percentage of coarse shale fragments increases with depth from about 30 percent in the surface layer to about 70 percent in the substratum. Black, brittle shale bedrock is at a depth of 30 inches.

Manlius soils are porous and have good potential for root development. Rooting depth generally is unrestricted above the shale bedrock. The water table is normally below a depth of 25 inches. Available water capacity is low to moderate. Droughtiness is a limitation in places. Permeability is moderate to moderately rapid. Natural fertility is medium to low, but crops respond well to fairly frequent applications of fertilizer. Lime needs generally are high.

Representative profile of Manlius shaly silt loam, 2 to 8 percent slopes, in a cultivated field in the town of Bennington; 4 miles west of the village of Attica, 200 feet west of Tinkham Road, just south of the Genesee County line:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) shaly silt loam; weak, fine, granular structure; very friable; many fine roots; 35 percent shale fragments; strongly acid; abrupt, smooth boundary.

B21—7 to 14 inches, yellowish-brown (10YR 5/4) very shaly silt loam; very weak, fine, subangular blocky structure; friable; few fine roots; many fine and medium pores; 45 percent shale fragments; strongly acid; clear, smooth boundary.

B22—14 to 22 inches, dark yellowish-brown (10YR 4/4) very shaly silt loam; very weak, fine, subangular blocky structure; friable; few fine roots; porous; 60 percent shale fragments; strongly acid; clear, smooth boundary.

C—22 to 30 inches, dark grayish-brown (10YR 4/2) to dark-brown (10YR 4/3) very shaly loam; very weak, medium, platy structure; slightly firm; porous; about 60 percent shale fragments in thin layers; strongly acid; abrupt, wavy boundary.

R—30 to 40 inches, black (10YR 2/1), brittle shale bedrock.

The solum, to the C horizon or to bedrock, ranges from 20 to 30 inches in thickness. Bedrock is at a depth of 20 to 40 inches. The content of coarse fragments, mainly shale, ranges from 15 to 40 percent in the Ap horizon and increases

with depth to 55 to 70 percent in the C horizon. It ranges from 35 to 55 percent in the B horizon. In some profiles, the C horizon is absent and the solum rests on bedrock. The solum ranges from very strongly acid to strongly acid. Most of the shale beds are black to dark-gray and brittle shale, but some areas contain a few thin layers of silty, nonbrittle, clayey shale.

The Ap horizon has a hue of 10YR, a value of 3 to 4, and a chroma of 2 or 3.

The B horizon has a hue of 10YR or 2.5Y, a value of 4 to 6, and a chroma of 3 to 6. This horizon is silt loam or loam.

Manlius soils are closely associated with Arnot, Aurora, Bath, Fremont, Lordstown, and Marilla soils. The Manlius soils are underlain by shale bedrock, but Arnot soils are underlain by sandstone and siltstone bedrock. Also, the Manlius soils are deeper to bedrock than the shallow Arnot soils. They are better drained, contain more shale, and are more acid than Aurora soils. These soils are shallower than Bath soils. They contain more coarse fragments and lack the fragipan of Bath soils. They are shallower to shale bedrock than somewhat poorly drained Fremont soils. The Manlius soils are very shaly, but the channery and flaggy rock fragments in the Lordstown and Arnot soils are mainly sandstone and siltstone. They are shallower to bedrock than the moderately well drained Marilla soils.

Manlius shaly silt loam, 2 to 8 percent slopes (MlB).—This soil has the profile described as representative for the series. It is gently sloping and has convex slopes. It is in areas of the shaly glacial till plateau in the northwestern corner of the county. This soil generally receives no runoff from adjacent slopes. Individual areas are circular and are about 25 acres in size.

Included with this soil in mapping, in about a third of the areas, were spots of nearly level Manlius soils. Also included were areas of Marilla soils where the soil is deeper, and also a few ledges of shale rock that has a soil mantle less than 20 inches thick.

This Manlius soil is suited to crops, pasture, or trees. Large areas of this soil are idle or are farmed at a fairly low level of intensity. This soil has good potential for crops.

Erosion is a slight hazard if this soil is cultivated and not protected. Natural fertility is medium to low, but response of crops to applications of lime and fertilizer is good. Capability unit IIe-2; woodland suitability group 3o1.

Manlius shaly silt loam, 8 to 15 percent slopes (MlC).—This soil is moderately sloping and is on the shaly glacial till plateau. The major area of this soil is on the sides of the shelflike landforms encountered as one ascends southward up the plateau from the Genessee County line. Most areas are in the town of Bennington, but other small areas are on some shoulders of the larger valleys. Individual areas are long and narrow and are about 20 acres in size.

Included with this soil in mapping were areas of deeper Marilla soils. A few ledges of shale bedrock that have a soil mantle less than 20 inches thick were also included.

This Manlius soil is suited to crops, pasture, or trees. About equal parts of this soil are wooded, are idle, or are being used for crops. Erosion is a moderate to severe hazard if this soil is cultivated and not protected. Lime and fertilizer needs generally are high. Dairy farming is the main enterprise. Capability unit IIIe-2; woodland suitability group 3o1.

Manlius shaly silt loam, 15 to 25 percent slopes (MlD).—This soil has a profile similar to the one described as representative for the series. About half of the areas are wooded, however, and many areas generally have a thinner and darker surface layer. This soil is moderately steep and is on the sides of the shaly glacial till plateau. Individual areas are commonly rectangular with the sloping dimension being shorter than the contour dimension. They are about 20 to 40 acres in size.

Included with this soil in mapping were large areas of higher lime Aurora soils, especially near the Oatka Valley. Also included were a few areas less than 1½ or more than 3½ feet deep over shale bedrock.

Most areas of this Manlius soil are wooded or idle. Some areas are used for crops, but because of the serious hazard of erosion, it is better suited to long-term hay or pasture. This soil is generally part of a relatively long slope, so gully erosion is a hazard if the soil cover is removed. Capability unit IVe-2; woodland suitability group 3r1.

Manlius shaly silt loam, 25 to 40 percent slopes (MlE).—This soil has a profile similar to the one described as representative for the series, except that most layers are thinner. It is steep and on sides of the shaly glacial till plateau. Most areas are long and narrow. A few incised areas of the plateau also include some of this soil. Lordstown soils commonly are above this soil, and Herkimer soils on fans that formed in rock and soil debris gouged out of the rock generally are below. Gullies and gorges are common landscape features.

Included with this soil in mapping were areas of soils in which shale bedrock is at a depth of less than 20 inches. Also included were Aurora soils where the rock stratum is much higher in lime than is typical for Manlius soils.

Most areas of this Manlius soil are wooded, and many cleared areas are idle. This soil is too steep to be used for crops. It provides some low-quality pasture in places, but it generally is better suited to trees or to some type of recreational use. Erosion is a serious hazard if the vegetation is disturbed. The steep slope and depth to shale bedrock are limitations for all uses. Capability unit VIe-2; woodland suitability group 3r1.

Manlius and Lordstown soils, 40 to 90 percent slopes (MnF).—This mapping unit consists of very steep Manlius and Lordstown soils. Either or both of these soils are present in a mapped area. Most areas are long and narrow and are along valley walls. Individual areas are 10 to 70 acres or more in size.

Both of these soils have a profile to the one described as representative for their respective series, but the thickness of the soil mantle over bedrock varies widely within short distances.

Included with this unit in mapping were areas of Rock outcrop, especially where drainageways cut the areas. Also included were many spots of Arnot soils where the sandstone bedrock is at a depth of less than 20 inches. Soils similar to the Manlius soil, but shallower over shale, were also commonly included. At the base of narrow steplike areas, small spots of deeper Bath soils were also included.

The areas of this unit are too steep for uses other than woodland and some types of recreational use. Most areas have not been cleared and remain in trees. Capability unit VIIe-2; woodland suitability group 4r1.

Mardin Series

The Mardin series is made up of deep, moderately well drained, medium-textured soils that formed in glacial till

that has a high content of sandstone and shale. These soils have a well-expressed fragipan at a depth of 14 to 24 inches. They are nearly level to moderately steep and are mainly on the upper slopes of the higher, till-covered areas in the southern half of the county.

In a representative profile the surface layer is dark grayish-brown channery silt loam 9 inches thick. The upper part of the subsoil is yellowish-brown, friable channery silt loam that extends to a depth of 12 inches and is strongly acid. A strongly acid, leached, pale-brown, channery loam layer, about 4 inches thick, that has some faint mottles separates the upper part of the subsoil from the underlying dense fragipan. Below a depth of 16 inches, the fragipan is dark yellowish-brown to olive-brown channery loam that has some faint mottles. This very firm, strongly acid layer has prisms separated by pale-brown streaks. From a depth of 28 down to 60 inches, the fragipan is olive-brown very channery loam that has a few distinct mottles. Reaction is medium acid in this part of the fragipan. The substratum is olive-brown very flaggy loam that extends to a depth of more than 70 inches. It is very firm and slightly acid.

In Mardin soils rooting depth is largely the 14 to 24 inches above the fragipan. This zone has moderate to low available water capacity. Free water generally is above the fragipan early in the growing season and during wet periods. Permeability is moderate above the fragipan and slow or very slow within and below the fragipan. These soils are strongly acid unless limed. They have a medium nutrient supplying power. Bedrock normally is much deeper than 40 inches below the surface, but it is at a depth of about 40 inches in some areas.

Representative profile of Mardin channery silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Orangeville, 3 miles southeast of hamlet of Varysburg, in a roadcut along Dunham Road, 300 feet east of intersection with Syler Road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) channery silt loam; weak, medium and fine, granular structure; friable; many roots; 20 percent coarse fragments; medium acid; abrupt, smooth boundary.

B2—9 to 12 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, fine, subangular blocky structure that crushes to weak, fine and very fine, granular; friable; common fine roots; many fine pores; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

A'2—12 to 16 inches, pale-brown (10YR 6/3) channery loam; common, medium, faint, yellowish-brown (10YR 5/4 and 5/6) mottles; weak, thin, platy structure; friable; few fine roots; many fine pores; 20 percent coarse fragments; strongly acid; abrupt, irregular boundary.

B'x1—16 to 28 inches, dark yellowish-brown (10YR 4/4), to olive-brown (2.5Y 4/4) channery loam; common, fine, faint, dark grayish-brown (10YR 4/2) mottles; strong, very coarse prisms separated by pale-brown (10YR 6/3) loam wedges ½ to 1½ inches wide at top and tapering to ⅛ inch wide at bottom; common, distinct, yellowish-brown (10YR 5/4) mottles within wedges; very weak, incipient, fine blocky structure within prisms; very firm and brittle; few fine roots between prisms; common fine pores; few clay films in pores; 30 percent coarse fragments; strongly acid; gradual, wavy boundary.

B'x2—28 to 60 inches, olive-brown (2.5Y 4/4) very channery loam; many fine and medium, faint, dark grayish-brown (2.5Y 4/2) and few, medium, distinct yellowish-brown (10YR 5/4–5/6) mottles; moderate, very coarse prisms 10 to 50 inches across, extending down from the horizon above; very firm and brittle; few fine pores with clay linings; 40 percent coarse fragments; medium acid; diffuse boundary.

C—60 to 70 inches, olive-brown (2.5Y 4/4) very flaggy loam; moderate, medium and thick, platy structure; very firm; thin, irregular, discontinuous, gray (10YR 5/1) streaks give a low-contrast mottled appearance; 50 percent coarse fragments; slightly acid.

The solum ranges from 40 to 70 inches in thickness. Bedrock is at a depth of 40 inches to many feet. The Bx horizon is at a depth of 14 to 24 inches. Content of coarse fragments ranges from 15 to 25 percent in horizons above the Bx horizon and from 20 to 60 percent in the Bx and C horizons.

The Ap horizon has a hue of 10YR, a value of 3 to 5, and a chroma of 2.

The B2 horizon has a hue of 2.5Y to 7.5YR, a value of 4 or 5, and a chroma of 4 to 6. It has weak subangular blocky or granular structure and is channery silt loam or channery loam. Mottling, if present, is faint.

The A'2 horizon has a hue of 2.5Y or 10YR, a value of 5 or 6, and a chroma of 2 to 4. This horizon ranges from fine sandy loam to silt loam. It is massive or has weak, thin, platy structure to very weak, medium, blocky structure. Consistence is firm to friable, and reaction ranges from very strongly acid to medium acid.

The Bx horizon has a hue of 5Y to 10YR, a value of 4 or 5, and a chroma of 2 to 4. This horizon ranges from loam to silt loam. It has strong, very coarse, prismatic structure to almost massive with vertical cleavage spaced 2 feet apart. Consistence is firm or very firm and brittle. Mottling in the Bx horizon is faint or distinct, and the mottles are concentrated in the light-colored material that separates the prisms. The upper part of the fragipan is strongly acid or very strongly acid. Reaction increases with depth but is no more than slightly acid at a depth of 40 inches.

The C horizon is calcareous in places at a depth of more than 70 inches. It is similar to the Bx horizon but lacks the prismatic structure and generally contains more coarse fragments.

Mardin soils are associated with the well-drained Bath soils that formed in similar material. Mardin soils are also near poorly drained Ellery soils that occupy adjacent wet areas. They are similar to and occupy the same kind of landscape as Canaseraga and Langford soils. They lack the thick silt mantle of Canaseraga soils and are more acid in the upper part of the Bx horizon than Langford soils. They are associated with the somewhat poorly drained Volusia soils that formed in similar material.

Mardin channery silt loam, 0 to 3 percent slopes (MrA).—This soil is nearly level and commonly has slightly convex slopes where some water accumlates, or runoff is slightly retarded. Drainage is not so favorable as on the more strongly sloping Mardin soils. Individual areas vary greatly in shape and size and range from 10 to 100 acres.

Included with this soil in mapping were small areas of poorly drained Ellery soils and the somewhat poorly drained Volusia soils in depressional areas and along drainageways. Also included were spots of less acid Langford soils on similar landscapes.

This Mardin soil is suited to most crops, pasture, or trees. It has a moderately good potential for crops. Planting is delayed early in spring in places because of wetness associated with the dense fragipan in the subsoil. Capability unit IIw-2; woodland suitability group 3o1.

Mardin channery silt loam, 3 to 8 percent slopes (MrB).—This soil has the profile described as representative for the series. It is gently sloping and commonly is on smooth areas that receive some runoff from adjacent soils. It is in large areas that surround small areas of well-drained Bath soils on knolls.

Included with this soil in mapping were small areas of similar but somewhat poorly drained Volusia soils in depressions or along foot slopes. Also included were better drained Bath soils on slight rises or knolls. These areas

generally are coarser textured in the subsoil. Also included were small areas of less acid Langford soils and silty Canaseraga soils.

This Mardin soil is suited to many crops, pasture, or trees. It has a moderately good potential for crops. Seasonal wetness delays planting in places, and erosion is a slight hazard if this soil is cultivated and not protected. Capability unit IIw-3; woodland suitability group 3o1.

Mardin channery silt loam, 8 to 15 percent slopes (MrC).—This soil is moderately sloping.

Included with this soil in mapping were areas of Bath and Volusia soils. In places areas of similar soils that have a coarser textured subsoil were included. Also included were finer textured and wetter Fremont soils in the south-central part of the county.

This Mardin soil is suited to many crops, and it is suited to pasture or trees. The hazard of erosion and drought are more serious limitations than they are on the less sloping Mardin soils. Seasonal wetness delays planting briefly in places. Capability unit IIIe-5; woodland suitability group 3o1.

Mardin channery silt loam, 15 to 25 percent slopes (MrD).—This moderately steep soil has a profile similar to the one described as representative for the series, but it generally is drier, and the surface layer generally is thinner because of erosion. This soil commonly is in narrow strips along the sides of ridges.

Included with this soil in mapping were areas of better drained Bath soils and small areas of less acid Langford soils. Also included were finer textured Fremont soils in the south-central part of the county.

This Mardin soil is suited to pasture and trees. It can be used for crops, but it is difficult and hazardous to work using modern equipment. Also, the hazard of erosion is severe if this soil is cultivated and not protected. Capability unit IVe-4; woodland suitability group 3r1.

Marilla Series

The Marilla series is made up of deep, moderately well drained soils that formed in glacial till derived mainly from dark-colored, brittle shale. These soils have a dense fragipan at a depth of about 15 to 25 inches. They are gently sloping to moderately sloping and are in areas of the Allegheny Plateau in the northwestern part of the county.

In a representative profile, in a cultivated area, the surface layer is dark grayish-brown shaly silt loam 7 inches thick. The upper part of the subsoil, to a depth of 18 inches, is yellowish-brown or light yellowish-brown, friable shaly silt loam that is faintly mottled in the lower part. The lower part of the subsoil, from a depth of 18 down to 42 inches, is a very shaly loam fragipan that is distinctly mottled. The substratum is very firm, olive-gray to olive very shaly loam that extends to a depth of more than 60 inches.

Marilla soils have free water perched above the fragipan in spring and during wet periods. The compact fragipan limits rooting depth to about 18 to 24 inches. Available water capacity is low to moderate. Permeability is moderate above the fragipan and slow or very slow in the fragipan and substratum. Natural fertility is low. Coarse fragments are mainly small, brittle, shale chips.

Representative profile of Marilla shaly silt loam, 2 to 8 percent slopes, in a cultivated field in the town of Bennington, 1½ miles north-northeast of hamlet of Bennington Center; on north side of County Road No. 5, 1,500 feet east of junction with State Route 77:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) shaly silt loam; weak, fine, granular structure; very friable; many fine roots; 15 percent shale fragments; strongly acid; abrupt, smooth boundary.

B21—7 to 14 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak, fine, subangular blocky structure; friable; common fine roots; many fine pores; 15 percent shale fragments; strongly acid; clear, smooth boundary.

B22—14 to 18 inches, light yellowish-brown (2.5Y 6/4) shaly silt loam; common, medium, faint, light olive-brown (2.5Y 5/6) mottles; weak, medium, platy structure; friable; common fine roots; many fine pores; 20 percent shale fragments; strongly acid; abrupt, irregular boundary.

Bx—18 to 42 inches, dark grayish-brown (2.5Y 4/2) to olive-brown (2.5Y 4/4) very shaly loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; distinct prisms, 12 to 15 inches wide; erratic streaks of gray (10YR 5/1) between prisms; many, medium, distinct, strong-brown (7.5YR 5/8) mottles on prism faces; weak, thick, platy structure in the prisms; very firm; brittle; few roots between prisms; common fine and medium pores; 40 percent shale fragments; strongly acid; clear, wavy boundary.

C—42 to 60 inches, olive-gray (5Y 4/2) to olive (5Y 4/3) very shaly loam; many, coarse, distinct, gray (10YR 5/1) and light olive-brown (2.5Y 5/4) mottles; massive; very firm but less brittle; 40 percent shale fragments; strongly acid.

The solum ranges from 40 to 50 inches in thickness. The fragipan is at a depth of 15 to 25 inches. Depth to bedrock ranges from 3½ to 30 feet, but most profiles are nearer the shallower end of this range. Content of coarse fragments ranges from 15 to 25 percent, by volume, to a depth of 18 inches. This increases with depth and generally is as much as 40 percent within a depth of 40 inches. The solum is strongly or very strongly acid, but the C horizon generally is medium acid below a depth of 50 inches. Hue ranges from 7.5YR to 5Y in the solum. Individual horizons range from light silty clay loam to sandy loam. The upper horizons are finer textured than the lower horizons. The sand sizes are dominantly minute shale chips.

The Ap horizon has a value of 3 or 4 and a chroma of 2 or 3.

The B horizon has a value of 4 to 6 and a chroma of 3 to 6. Few-to-common, faint-to-distinct, high-chroma mottles are at a depth of 12 to 18 inches. This horizon generally has weak, fine, subangular blocky structure in the upper part and weak, coarse, prismatic or thick platy in the lower part. Consistence is friable in the B21 and B22 horizons and firm or very firm and brittle in the fragipan.

The C horizon is massive and ranges from firm to very firm and brittle.

Marilla soils are similar to the Langford and Mardin soils, but they have a very shaly fragipan, which is lacking in these soils. Also, Marilla soils are associated with Fremont and Manlius soils that formed in shaly till. They are drier and have a coarser textured B horizon than Fremont soils, which also lack the fragipan of Marilla soils. The Marilla soils are deeper than Manlius soils over bedrock and have a fragipan which is lacking in Manlius soils.

Marilla shaly silt loam, 2 to 8 percent slopes (MsB).—This gently sloping soil has the profile described as representative for the series. Individual areas are irregular in shape and range from 10 to 50 acres or more in size.

Included with this soil in mapping were large areas of nearly level Marilla soils. This inclusion and some of the lower parts of gently sloping areas are wetter than typical Marilla soil. Also included were the well-drained Manlius soils and the wetter and finer textured Fremont soils.

This Marilla soil is suited to most row crops, and it is

suited to pasture or trees. About one-fourth of this soil is wooded, and the remainder is about equally divided between crops and idle areas. An increasing amount is becoming idle each year. Seasonal wetness delays planting in places. The hazard of erosion is slight to moderate if this soil is cultivated and not protected. Generally lime and fertilizer needs are high. Capability unit IIw-3; woodland suitability group 3o1.

Marilla shaly silt loam, 8 to 15 percent slopes (MsC).—This moderately sloping soil has a profile similar to the one described as representative for the series, but it commonly contains more shale fragments. It receives runoff from adjacent gently sloping soils in places. Individual areas are irregular in shape to roughly circular. They range from 15 to 50 acres in size. This soil is limited in extent.

Included with this soil in mapping were areas of Manlius soils and a few thin bands of finer textured Fremont soils.

This Marilla soil is suited to crops, pasture, or trees. The hazard of erosion is serious if this soil is cultivated and not protected. About one-third of the acreage of this soil is wooded, and most of the rest is in pasture or is idle. Very few areas are used for row crops. An increasing amount of this land is being used for recreation or is planted to trees. Planting is delayed briefly because of seasonal wetness in places. Lime and fertilizer needs are high. Capability unit IIIe-5; woodland suitability group 3o1.

Niagara Series

The Niagara series is made up of deep, somewhat poorly drained, medium-textured soils that formed in silty material that was deposited in glacial lakes. These soils are nearly level and are in valleys in the northern half of the county.

In a representative profile the surface layer is very dark grayish-brown silt loam 9 inches thick. The subsurface layer is grayish-brown silt loam, 4 inches thick, that is friable and slightly acid. The subsoil is neutral, firm, and dark grayish brown. It is between depths of 13 and 36 inches. It ranges from heavy silt loam in the upper 5 inches to light silty clay loam in the lower part. It is distinctly mottled. The substratum, to a depth of more than 50 inches, is mottled grayish-brown silt loam that has a stratum of very fine sand in places. It is calcareous.

Niagara soils have a seasonal high water table within a foot of the surface early in spring and during other excessively wet periods. In the middle of summer the rooting depth is 15 to 24 inches. Available water capacity is moderate to high. Permeability is moderately slow in the solum and moderately slow or slow in the substratum. These soils have medium ability to supply phosphorus and potassium. Lime needs are medium to low.

Representative profile of Niagara silt loam (0 to 3 percent slopes) in a cultivated field in the town of Bennington, 2 miles north of Varysburg, on State Route 98, about 500 feet southeast of junction with Eck Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) when dry; moderate, medium, granular structure; very friable; many fine roots; slightly acid; abrupt, smooth boundary.

A2—9 to 13 inches, grayish-brown (10YR 5/2) silt loam; many, fine and medium, distinct, yellowish-brown (10YR 5/4) mottles; very weak, medium, subangular blocky structure; friable; common fine roots; slightly acid; abrupt, irregular boundary that interfingers into B21 horizon.

B21t—13 to 18 inches, dark grayish-brown (10YR 4/2) heavy silt loam; grayish-brown (10YR 5/2) silt on ped faces; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; few fine roots; neutral; clear, smooth boundary.

B22t—18 to 28 inches, dark grayish-brown (10YR 4/2) light silty clay loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure within moderate, medium, prismatic; grayish-brown (10YR 5/2) clay coats on ped surfaces; firm; neutral; gradual, smooth boundary.

B23t—28 to 36 inches, dark grayish-brown (10YR 4/2) light silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) and light-brown (2.5Y 5/4) mottles; moderate, coarse, subangular blocky structure; firm; many clay coats in pores and on ped surfaces; neutral; clear, wavy boundary.

C—36 to 50 inches, grayish-brown (2.5Y 5/2) silt loam that has some very fine sand strata; few, coarse, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, thick, platy structure; firm; calcareous; moderately alkaline.

The solum ranges from 30 to 40 inches in thickness. Carbonates are at a depth of 30 to 50 inches. The upper part of the solum is medium acid to neutral, and the lower part is slightly acid to mildly alkaline. The solum has a hue of 7.5YR to 2.5Y. The solum is less than 2 percent coarse fragments. Bedrock is at a depth of more than 75 inches and generally is at a depth of more than 10 feet.

The Ap horizon has a value of 3 or 4 and a chroma of 2 or 3 when the soil is moist and broken, and a value of 6 when the soil is dry and crushed.

The A2 horizon is similar in color to the Ap horizon except that the value is 5 or 6.

The B horizon has a value of 4 or 5 and a chroma of 2. Mottles have a value of 4 or 5 and a chroma of 3 to 6. This horizon has moderate, medium to coarse, blocky structure.

The C horizon is commonly stratified silt and very fine sand. In places, however, there are thin layers that are higher in content of clay.

In places Niagara soils are near Caneadea soils that have a finer textured B horizon. These soils are closely associated with moderately well drained Collamer soils that formed in similar material. They also occupy the same kind of landscape as Wallington soils, but they are less acid and lack the fragipan of Wallington soils.

Niagara silt loam (Ng).—This is the only Niagara soil mapped in the county. It is level or nearly level and is in areas within valley basins. Some runoff is received from dryer adjacent soils. This soil generally is free of coarse fragments and is easy to cultivate. Individual areas are irregular in shape and range from about 10 to 20 acres in size.

Included with this soil in mapping were areas of finer textured Caneadea soils and more acid Wallington soils that have a dense fragipan. Also included, in places, were areas of similar soils that have a gravelly subsoil or lack of a subsoil as high in content of clay. Small wet spots and areas of drier Collamer soils on knolls were also included.

Undrained areas of this Niagara soil are suited to grain crops, hay, pasture, or trees. Drainage inceases usability of the soil. Capability unit IIIw-1; woodland suitability group 3w1.

Nunda Series

The Nunda series is made up of deep, moderately well drained soils that formed in a thick contrasting loamy surface mantle underlain by moderately fine textured, shaly, calcareous glacial till. These soils are gently sloping to moderately steep and are along the northern fringes of the Allegheny Plateau.

In a representative profile the surface layer is dark grayish-brown silt loam 8 inches thick. The subsurface layer is medium acid, friable silt loam that extends to a depth of 23 inches. This layer is yellowish brown to a depth of 17 inches, and grayish brown to a depth of 23 inches. The upper part of the subsoil is firm, distinctly mottled, brown to dark-brown silt loam, 4 inches thick. It is slightly acid in reaction. The soil to this depth contains very few coarse fragments. The lower part of the subsoil, to a depth of 42 inches, is firm, mottled, dark grayish-brown to olive-brown silty clay loam that contrasts with the horizons above. It is mainly neutral in reaction but becomes mildly alkaline with depth. This part of the subsoil is about 10 percent shale fragments. The substratum is olive-gray shaly silt loam that is firm and calcareous. It extends to a depth of more than 50 inches.

Nunda soils have a water table at a depth of 18 to 30 inches during wet periods. Seasonal wetness is a slight limitation. The rooting depth is 2 or 3 feet. Available water capacity is moderate to high. Permeability is moderate in the silty mantle, moderately slow in the lower part of the subsoil, and slow or very slow in the substratum. Natural fertility is medium in the upper part of the profile. Potassium reserves are higher in the subsoil. Bedrock generally is at a depth of 6 to 12 feet.

Representative profile of Nunda silt loam, 2 to 8 percent slopes, in a cultivated field in the town of Middlebury, 1 mile north of the village of Wyoming, off County Road No. 7:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; very friable; many fine roots; 5 percent coarse fragments; medium acid; abrupt, smooth boundary.

A21—8 to 17 inches, yellowish-brown (10YR 5/4) silt loam; very weak, fine, subangular blocky structure; friable; common fine roots; many pores; 5 percent coarse fragments; medium acid; gradual, smooth boundary.

A22—17 to 23 inches, grayish-brown (2.5Y 5/2) silt loam; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; very weak, medium, subangular blocky structure; friable; few fine roots; common pores; 5 percent coarse fragments; medium acid; clear, wavy boundary.

B1—23 to 27 inches, brown to dark-brown (10YR 4/3) silt loam; weak to moderate, fine and medium, subangular blocky structure; firm; distinct interfingering of A22 material into this layer; common, medium, distinct, yellowish-brown (10YR 5/6) mottles on ped faces; some clay films in pores within peds; few roots; common pores; 5 percent coarse fragments; slightly acid; clear, smooth boundary.

IIB21t—27 to 33 inches, dark grayish-brown (2.5Y 4/2) silty clay loam; many, medium, faint, olive-brown (2.5Y 4/4) and dark yellowish-brown (10YR 4/4) and few olive-gray (5Y 5/2) mottles; moderate, medium, subangular blocky structure; firm; clay films in pores, patchy on ped faces; few pores; 10 percent shale fragments; neutral; gradual, clear boundary.

IIB22t—33 to 42 inches, dark grayish-brown to olive-brown (2.5Y 4/2–4/4) silty clay loam; moderate, medium, subangular blocky structure in weak, very thick, prismatic; firm; few pores; 10 percent shale fragments; continuous clay films on ped faces; neutral to mildly alkaline; clear, smooth boundary.

IIC—42 to 50 inches, olive-gray (5Y 4/2) shaly silt loam; weak, thick, platy structure; firm; 20 to 25 percent shale fragments; calcareous.

The solum ranges from 30 to 45 inches in thickness. Carbonates are at a depth of 32 to 50 inches. The upper silty or loamy mantle ranges from 15 to 30 inches in thickness. Content of coarse fragments, dominantly shale, ranges from 10 to 25 percent. Bedrock is at a depth of 45 inches to 15 feet.

The A horizon is entirely within the mantle of loam or silt loam that is less than 18 percent clay and is 0 to 10 percent coarse fragments. The A horizon has a hue of 10YR or 2.5Y. The A21 horizon has a value of 4 or 5. Mottles are either not present or only faint. The A22 horizon has a value of 5 or 6 and a chroma of 2 or 3. It has common to many, distinct mottles that have a chroma of 4 to 6.

The IIB2t horizon has a hue of 10YR to 5Y, a value of 4 or 5, and a chroma of 2 to 4. Mottles of 2 chroma are present when the chroma of the matrix is 3 or 4.

Nunda soils commonly are adjacent to somewhat poorly drained Burdett soils, which formed in similar material. Nunda soils are similar to soils of the Conesus, Danley, and Lansing series, all of which lack the thick contrasting surface mantle of Nunda soils. Also, Nunda soils have a finer textured Bt horizon than Conesus and Lansing soils. They are commonly adjacent to the very poorly drained Ilion soils.

Nunda silt loam, 2 to 8 percent slopes (NuB).—This gently sloping soil has the profile described as representative for the series. It is commonly in areas that include large areas of soils that have nearly level convex slopes. This soil is in the higher areas, and it loses runoff water to the lower, adjacent areas commonly occupied by steeper phases of Nunda soils and wetter Burdett or Darien soils.

Included with this soil in mapping were spots of Conesus soils in areas where the loamy or silty ablation till mantle is more than 40 inches thick. Also included were areas of similar, but wetter, Burdett soils in small depressions and along drainageways. In areas where this contrasting upper silty or loamy mantle is less than 15 inches thick, Danley soils were included. Areas of soils along Cayuga Creek that have underlying contrasting deposits of lacustrine silt and clay rather than till were also included.

This Nunda soil is suited to crops, pasture, or trees. Most crops that are suited to the climate can be grown in this soil. Common crops are those that are used in support of dairy operations. The hazard of erosion is moderate to severe if this soil is cultivated and not protected. Seasonal wetness delays planting in places, and some included wet spots need drainage. Capability unit IIe–5; woodland suitability group 2o1.

Nunda silt loam, 8 to 15 percent slopes (NuC).—This moderately sloping soil has a profile similar to the one described as representative for the series, but the upper part of the subsoil is thinner and is leached.

Included with this soil in mapping were small areas of wetter Burdett soils along drainageways and foot slopes. Also included were areas of similar Conesus, Danley, and Lansing soils. Areas of soils near Cayuga Creek, where the contrasting lower deposits are lacustrine silt and clay rather than shaly till, were also included.

This Nunda soil is suited to crops, pasture, or trees. It is used mainly for crops grown in support of dairy operations. If cultivated, the hazard of erosion is severe, and erosion control is needed. Seasonal wetness delays planting briefly in places. Slopes are a moderate limitation to the use of heavy machinery. Capability unit IIIe–6; woodland suitability group 2r2.

Nunda silt loam, 15 to 25 percent slopes (NuD).—This moderately steep soil has a profile similar to the one described as representative for the series, but the surface layer is thinner, and the soil contains less organic matter and is more acid. This soil generally is on long side slopes above the Oatka Valley. A large area of it is on the sides of the valley of Cayuga Creek.

Included with this soil in mapping were areas of Aurora soils mainly in gullies. Also included were areas of Danley and Lansing soils that have a loamy or silty mantle less than 15 inches thick. These inclusions make up about 35 percent of this unit.

This Nunda soil is better suited to hay, pasture, or trees than to crops. Slope and the hazard of erosion are limitations to the use of this soil for crops. Capability unit IVe-5; woodland suitability group 2r1.

Palms Series

The Palms series is made up of 16 to 50 inches of organic material over mineral soil material. These nearly level soils are very poorly drained and are in small pockets in low areas throughout the county.

In a representative profile the surface layer is black muck, 15 inches thick, that is medium acid. It contains some silt but no wood fragments. From a depth of 15 down to 25 inches is very dark brown muck that is slightly acid. It contains some mineral and wood fragments. From a depth of 25 down to 40 inches is black to dark reddish-brown muck that is neutral in reaction. It contains woody fragments but no mineral. To this depth the soil is very friable and porous. From a depth of 40 down to 60 inches or more, the substratum is light-gray to gray fine sandy loam that is calcareous.

Palms soils are organic and are wet unless some kind of an artificial drainage system is installed. Some areas are adjacent to lakes or permanent streams and are very difficult or impossible to drain. If drained and farmed, however, they are very productive. Permeability is moderate or moderately rapid in the organic material and moderate to moderately slow in the underlying mineral deposit.

Representative profile of Palms muck in a wooded area in the town of Middlebury, on the north side of County Road No. 47, 1,000 feet east of junction with Kingsley Road:

Oa1—0 to 15 inches, black (10YR 2/1) broken and rubbed, muck; moderate, medium and coarse, granular structure; very friable; less than 5 percent fiber undisturbed; less than 1 percent fiber crushed; many roots; 10 percent silt; medium acid; clear, smooth boundary.

Oa2—15 to 25 inches, very dark brown (10YR 2/2) broken and rubbed, muck; weak, medium, granular structure; very friable; less than 10 percent fiber undisturbed; less than 3 percent fiber crushed; a few wood fragments; few roots; 10 percent silt; slightly acid; gradual, smooth boundary.

Oa3—25 to 40 inches, black (5YR 2/1) broken, dark reddish-brown (5YR 2/2) crushed, muck; very weak, coarse, granular structure; very friable; 30 percent fiber undisturbed; 5 percent fiber crushed; a few wood fragments; neutral; abrupt, smooth boundary.

IICg—40 to 60 inches, light-gray to gray (10YR 6/1) fine sandy loam; massive; friable; calcareous; mildly alkaline.

The underlying loamy mineral soil is at a depth of 16 to 50 inches. The organic part ranges from medium acid to mildly alkaline. This part has a hue of 10YR to 5YR, a value of 2 or 3, and a chroma of 1 or 2.

The IIC horizon is light-gray to grayish-brown fine sandy loam, loam, or silt loam that contains as little as a few or as much as 20 percent coarse fragments. This horizon ranges from neutral to mildly alkaline, and it is calcareous in places.

Palms soils are on landscapes similar to those of Alden, Halsey, Papakating, and Wallkill soils. These soils have a thicker muck layer over mineral soil than the Alden, Halsey, and Papakating soils. They lack the mineral cap over muck that is characteristic of the Wallkill soils.

Palms muck (Pa).—This is the only Palms soil mapped in the county. It is nearly level and is in scattered depressional areas throughout the county. It is permanently wet unless artificially drained. Small areas generally are round, and larger areas are more irregular in shape.

Included with this soil in mapping, around the margins of the muck, were spots of Alden or Papakating soils that have a thin mucky surface layer. Also included were areas of Wallkill soils where thin mantles of alluvium are over the muck bed. At the southern end of Silver Lake and in some areas adjacent to Java Lake, some areas of freshwater marsh were included.

This Palms soil is suited to vegetable crops if drained. A few areas have been drained and cleared, but most areas are undrained. Drainage is not feasible in some areas. This soil is a potential source of muck and peat. Capability unit, not assigned; woodland suitability group 4w1.

Palmyra Series

The Palmyra series is made up of deep, well-drained to excessively drained, medium-textured, gravelly soils that formed in calcareous outwash deposits of sand and gravel. These soils are nearly level to gently sloping. They are on terraces in the north-central and northeastern part of the county.

In a representative profile, the surface layer is dark grayish-brown gravelly loam 9 inches thick. The subsurface layer is pale-brown, friable gravelly loam, 3 inches thick, that intrudes into the upper part of the subsoil at a depth of about 12 inches. The subsoil is brown, friable gravelly loam to a depth of about 17 inches. From 17 down to 29 inches, it is brown gravelly loam to light clay loam that is firm and slightly sticky. The subsoil is neutral in reaction. The content of gravel in the subsoil increases with depth. The substratum is at a depth of about 29 inches. The upper part is grayish-brown very gravelly sandy loam that is calcareous. At a depth of 38 inches, the substratum is stratified, calcareous sand and gravel. This material extends to a depth of 46 inches or more.

Palmyra soils have unrestricted rooting depth. Available water capacity is low to moderate. These soils are very porous. Permeability is moderate or moderately rapid in the surface layer and subsoil and rapid or very rapid in the substratum. Natural reserves of phosphorus and potash are medium. Lime needs are low. In places stoniness is a slight limitation for some uses. These soils are among the better soils in the county for farming.

Representative profile of Palmyra gravelly loam, 0 to 3 percent slopes, in a cultivated field in the town of Covington, 1 mile north of State Route 19, in gravel pit on west side of Crossman Road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam; moderate, medium, granular structure; very friable; many fine roots; 25 percent gravel; slightly acid; abrupt, smooth boundary.

A2—9 to 12 inches, pale-brown (10YR 6/3) gravelly loam; weak,

fine, granular structure; friable; common fine roots; porous; 25 percent gravel; slightly acid; clear, irregular boundary that interfingers around peds into the upper part of the B21t horizon.

B21t—12 to 17 inches, brown (7.5YR 4/4) gravelly loam; moderate, fine and medium, subangular blocky structure; friable; common fine roots; porous; neutral; 25 percent gravel; thin patchy clay films on some pebbles; clear, wavy boundary.

B22t—17 to 29 inches, brown (10YR 5/3) gravelly loam to light clay loam; moderate, medium, subangular blocky structure; firm, slightly sticky; some dark-brown (10YR 3/3) clay coats on pebbles and ped faces; few fine roots; 35 percent gravel; mildly alkaline; clear, irregular boundary that has tapering tongues extending into the C horizon.

IIC1—29 to 38 inches, grayish-brown (10YR 5/2) very gravelly sandy loam; single grain; loose; 50 percent gravel; calcareous; moderately alkaline; abrupt, wavy boundary.

IIC2—38 to 46 inches, grayish-brown (10YR 5/2) interstratified fine and medium sand and gravel; calcareous; moderately alkaline.

The solum ranges from 17 to 30 inches in thickness and corresponds to the depth to carbonates. The content of coarse fragments, mainly gravel, ranges from 10 to 35 percent. The solum ranges from slightly acid to mildly alkaline. Bedrock is at a depth of more than 6 feet.

The A horizon ranges from dark brown to dark grayish brown. Hue is 7.5YR or 10YR in this horizon.

The Bt horizon tongues deeply into the C horizon. Discontinuous tongues from the A2 horizon form cone-shaped extensions inside the upper part of the tongues. This causes a widely varying thickness of the solum.

The C horizon is stratified sand and gravel of various sizes. The pebbles are of mixed origin and vary in amount of limestone, sandstone, and shale. The content of coarse fragments in the C horizon ranges from 40 to 70 percent.

Palmyra soils are near sandy Arkport soils, which, unlike Palmyra soils, are not gravelly. Palmyra soils are commonly associated with similar, but wetter, Homer and Phelps soils that are in lower adjacent areas. They are similar to Howard soils, but they contain less gravel in the B horizon and are shallower to carbonates.

Palmyra gravelly loam, 0 to 3 percent slopes (PgA).—This nearly level soil has the profile described as representative for the series. It is on gravelly terraces that vary considerably in size and shape. Individual areas range from 5 to 80 acres or more in size.

Included with this soil in mapping were areas of wetter, gravelly Homer and Phelps soils in slight depressions. Also included were areas of Herkimer soils in areas where terraces merge with alluvial fans.

This Palmyra soil is well suited to most crops. Dairying and cash crops are the primary farm enterprises. Crops such as alfalfa and corn are very well suited. Available water capacity is slightly better than on the gently sloping Palmyra soils, but in dry periods, droughtiness is a slight limitation to use in places. Coarse gravel fragments limit tillage and harvesting operations in places. Capability unit IIs–1; woodland suitability group 2o2.

Palmyra gravelly loam, 3 to 8 percent slopes (PgB).—This soil is gently undulating where it is on gravelly outwash terraces, and it is sloping where it is along the perimeter around these terraces. Individual areas range from 5 to 20 acres in size.

Included with this soil in mapping were small areas of moderately sloping Palmyra soils. Also included were areas of wetter Homer and Phelps soils in depressions and on foot slopes.

This Palmyra soil is well suited to intensive use for most crops grown in conjunction with dairy or cash-crop farming. Crops such as alfalfa and corn are very well suited. The hazard of erosion is slight in areas where the soil is more sloping. Available water capacity is slightly lower than it is in the nearly level Palmyra soils. Droughtiness is a limitation in places during drier periods. Coarse fragments limit certain tillage and harvesting operations in places. Capability unit IIs–2; woodland suitability group 2o2.

Papakating Series

The Papakating series is made up of deep, poorly drained and very poorly drained, medium-textured soils that are medium acid or slightly acid. These nearly level soils formed in alluvium. They are in the wet areas along all but the largest meandering creeks and rivers.

In a representative profile the surface layer is very dark grayish-brown mucky silt loam 8 inches thick. A few mottles are along root channels in this layer. The subsurface layer and the subsoil are dark-gray, friable silt loam. They are distinctly mottled and extend from a depth of 8 to 32 inches. From a depth of 32 down to 40 inches, the upper part of the substratum is slightly sticky, dark-gray silt loam that has many distinct mottles. From a depth of 40 down to 60 inches or more, the substratum is gray very gravelly loamy sand that contains about 40 percent coarse fragments. These soils are slightly acid to medium acid throughout the profile.

Papakating soils have a water table at or near the surface for long periods. Rooting depth is rather limited because of this high water table. These soils are subject to frequent flooding. Available water capacity is high. Permeability is moderate to moderately slow in the subsoil and the upper part of the substratum and rapid in the lower part of the substratum. Natural fertility is medium to high.

Representative profile of Papakating mucky silt loam in an idle area in the town of Pike, 1 mile northwest of the village of Pike on Albro Road, one-fourth mile south of State Route 39, 20 feet west of Albro Road:

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) mucky silt loam; black (10YR 2/1) rubbed; few, fine, dark reddish-brown (5YR 3/4) root mottles; moderate, medium, granular structure; friable; many fine roots; slightly acid; clear, smooth boundary.

A3g—8 to 14 inches, dark-gray (N 4/0) silt loam; common, fine, distinct, dark reddish-brown (5YR 3/3) mottles; moderate, coarse, granular structure and some subangular blocky peds; friable; common fine roots; common fine pores; slightly acid; clear, smooth boundary.

Bg—14 to 32 inches, dark-gray (10YR 4/1) silt loam; common, fine, distinct, dark reddish-brown (5YR 3/4) mottles; weak, fine, subangular blocky structure; friable; few fine roots in upper part; few fine pores; slightly acid; clear, wavy boundary.

C1g—32 to 40 inches, dark-gray (5Y 4/1) silt loam; many, fine and medium, prominent, strong-brown (7.5YR 5/6) mottles; massive; friable, slightly sticky; few fine pores; medium acid; clear, smooth boundary.

IIC2g—40 to 60 inches, gray (5YR 5/1) very gravelly loamy sand; stratified; single grain; loose; 40 percent gravel; medium acid.

The solum ranges from 20 to 36 inches in thickness. Bedrock is at a depth of 6 feet or more. Coarse fragments are absent or scarce to a depth of 40 inches. Stratified sand and gravel generally are at a depth of 38 to 45 inches. The solum has a hue of 10YR to 5Y. It is medium acid to slightly acid.

The Ap or A1 horizon has a value of 2 or 3 when moist and 4 when dry and a chroma of 1 or 2. It generally is silt loam or mucky silt loam and high in content of organic matter. It makes up less than one-third the thickness of the solum. It has moderate or strong granular structure.

The A3g horizon is similar to the A1 horizon, but it has a value of 4 when moist and a chroma of 0 to 1. A gleyed layer with gray (N 5/0 or 6/0) color and having a few or no mottles replaces the A3g horizon in some profiles.

The Bg horizon has a value of 4 or 5 and a chroma of 1 or 2. It has common, distinct to prominent mottles of higher chroma. This horizon is silt loam or silty clay loam.

The C1g horizon is similar in color and texture to the Bg horizon, but it lacks structure.

The IIC2g horizon consists of stratified sand, silt, and gravel. In places it is at a depth of more than 38 inches.

Papakating soils are similar to Wallkill and Wayland soils that formed in alluvium. They are more acid in the upper part of the subsoil than Wayland soils, and they lack the mucky substratum of Wallkill soils. Papakating soils are closely associated with well-drained Tioga soils that formed in similar material on flood plains.

Papakating silt loam (Pk).—This poorly drained soil has a profile similar to the one described as representative for the series, but it lacks the high content of organic matter, or muckiness, in the surface layer. It is nearly level and is on flood plains adjacent to streams in the southern part of the county. These streams drain the more acid uplands of the plateau. Individual areas generally are long and narrow and less than 200 feet from the stream.

Included with this soil in mapping were a few large areas of a similar, but somewhat poorly drained, soil and some spots of mucky Papakating soils. Also included were areas of soils that have stratified sand and gravel at a depth of 20 to 40 inches and that make up a third of the mapped areas.

About equal areas of this Papakating soil are wooded, in pasture, or are idle. Prolonged wetness is the major limitation to use for crops, and adequate drainage outlets are difficult to establish. Occasionally a row crop is planted where this soil is part of an adjacent cultivated field of better drained soils. This soil generally is flooded in spring, but flooding seldom occurs during the growing season. Streams, such as East Koy and Wiscoy Creeks, where areas of this soil occur, do not have the tendency to flood as do the streams that have wide meander belts, such as Oatka Creek. Capability unit IVw-4; woodland suitability group 4w2.

Papakating mucky silt loam (Pm).—This nearly level, very poorly drained soil has the profile described as representative for the series. It is on flat or depressional areas of flood plains adjacent to streams in the southern part of the county. These streams drain the more acid uplands of the plateau. Most individual areas are long and narrow, and they generally are within 200 feet of the stream.

Included with this soil in mapping were spots of soils that have stratified sand and gravel at a depth of 20 to 40 inches. They make up about one-fourth of the mapped areas. Also included were small areas of Palms muck.

Unless this Papakating soil is drained and protected from flooding, it is unsuitable for farming. Most of this soil has a vegetative cover of water-tolerant brush or brushy pasture. This soil is subject to frequent flooding, and the water table rarely drops below a depth of 10 inches. Capability unit IVw-5; woodland suitability group 4w1.

Phelps Series

The Phelps series is made up of deep, moderately well drained, medium-textured soils that formed in calcareous glacial outwash. These soils are nearly level to gently sloping and are on valley terraces in the northern half of the county.

In a representative profile, in a cultivated area, the surface layer is dark grayish-brown gravelly loam about 9 inches thick. The subsurface layer, 3 inches thick, is faintly mottled brown gravelly loam that is friable and that interfingers into the upper part of the subsoil at a depth of about 12 inches. The upper part of the subsoil, from a depth of 12 down to 16 inches, is brown to dark-brown, friable gravelly loam that is faintly mottled. From a depth of 16 down to 28 inches, the subsoil is firm, sticky, brown to dark-brown gravelly loam that is distinctly mottled. The lower part of the subsoil, below a depth of 28 inches, is faintly mottled, brown to dark-brown, friable gravelly sandy loam. The substratum, from 36 down to 50 inches or more, is faintly mottled, grayish-brown, loose very gravelly sand that is calcareous and stratified. The surface and subsurface layers and the subsoil are slightly acid to neutral.

Phelps soils have a seasonal high water table within a depth of 18 inches early in spring and during other excessively wet periods. The water table in this porous soil generally is part of that in enclosed basins. Rooting depth is normally 24 to 30 inches during the growing season. Available water capacity is moderate. Permeability is moderate in the subsoil and moderately rapid or rapid in the substratum. Lime needs generally are low. Supplies of phosphorus and potash are medium.

Representative profile of Phelps gravelly loam, 0 to 3 percent slopes, in a cultivated field in the town of Covington, 1½ miles south of Pavilion on State Route 19:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam; moderate granular structure; friable; many roots; many pores; 25 percent gravel; slightly acid; abrupt, smooth boundary.

A2—9 to 12 inches, brown (10YR 5/3) gravelly loam; few, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate, medium, platy structure; friable; common roots; many pores; 25 percent gravel; slightly acid; abrupt, wavy boundary.

B&A—12 to 16 inches, brown to dark-brown (10YR 4/3) gravelly loam; few, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; common pores; peds coated with washed fine sand grains; 25 percent gravel; slightly acid; clear, wavy boundary.

B2t—16 to 28 inches, brown to dark-brown (10YR 4/3) gravelly loam; common, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; 30 percent gravel fragments; common roots; common pores; clay films on 20 percent of ped faces and in most pores; neutral; clear, wavy boundary.

B3—28 to 36 inches, brown to dark-brown (10YR 4/3) gravelly sandy loam; few, faint, yellowish-brown (10YR 5/4) mottles; weak, coarse, subangular blocky structure; friable; common clay films; few roots in upper part; common pores; 35 percent gravel; neutral; clear, smooth boundary.

IIC—36 to 50 inches, grayish-brown (10YR 5/2) very gravelly sand; few, faint, dark yellowish-brown (10YR 4/4) mottles; single grain becoming weakly stratified with depth; loose; 45 percent gravel; calcareous; moderately alkaline.

The solum ranges from 24 to 36 inches in thickness. Carbonates are at a depth of 28 to 40 inches. Bedrock is at a depth of 6 feet or more. The content of gravel is as much as 35 percent. The solum ranges from medium acid to neutral in the surface layer and slightly acid to mildly alkaline in the B horizons.

Tonguing of the A2 horizon into the B horizon ranges from thin films containing clean sand grains on ped faces, in the upper 4 inches of the B horizons, to tongues of the A2 horizon that are 1 inch wide at the top and extend to depths of as much as 8 inches into the B horizon.

The B horizon has a hue of 7.5YR to 2.5Y, a value of 3 to 5 when moist, and a chroma of 3 or 4. Mottles are mostly of higher chroma than the matrix, but some mottles have a chroma of 2.

The B2 horizon has thin patchy clay films on 10 to 30 percent of the ped faces, and most pores within peds have clay linings. The gravelly and sandy contrasting IIC horizon is at a depth of 30 to 40 inches.

Phelps soils are closely associated with the wetter Halsey and Homer soils and the better drained Howard and Palmyra soils, all of which formed in similar material. They occupy the same kind of landscape as more acid Castile soils and Scio soils that formed in thick silt deposits.

Phelps gravelly loam, 0 to 3 percent slopes (PpA).—This soil has the profile described as representative for the series. It is nearly level and is on low-lying stream terraces and in slight depressional areas within areas of better drained Howard and Palmyra soils. This soil receives some runoff from adjacent slopes in places. Individual areas vary in size and shape, and range from 5 to 25 acres.

Included with this soil in mapping were areas of wetter, gravelly Halsey and Homer soils. Also included were areas of drier Howard and Palmyra soils on slightly higher rises.

This Phelps soil is well suited to most crops and can be cultivated intensively. Cash crops and those used for dairy farming are the main crops. Because of a seasonal high water table, this soil generally is not ready for cultivation as early as the associated drier Howard or Palmyra soils. Gravel fragments limit tillage and harvesting operations in places. Capability unit IIw-1; woodland suitability group 2o2.

Phelps gravelly loam, 3 to 8 percent slopes (PpB).—This gently sloping soil is on low stream terraces or is adjacent to the Howard or Palmyra soils at higher elevation. Areas are parallel to the valley streams. Individual areas vary in shape. They range from 5 to 20 acres in size.

Included with this soil in mapping were spots of drier Howard and Palmyra soils in slightly higher areas. Also included were areas of wetter Halsey and Homer soils in small depressions. The latter areas are indicated on the soil map by the symbols for wet spots or drainage. A few seep spots or springlike areas were also included. Where this soil merges with silty alluvial soils, small areas of soils were included along foot slopes.

This Phelps soil can be used intensively for crops. Dairying and cash crops are the main farming enterprises. The seasonally high water table is not so limiting for early season cultivation as it is on the less sloping Phelps soils. Gravel fragments limit some tillage and harvesting operations in places. The hazard of erosion is slight to moderate if this soil is cultivated and not protected. Capability unit IIe-4; woodland suitability group 2o2.

Red Hook Series

The Red Hook series is made up of deep, somewhat poorly drained, medium-textured, gravelly soils that formed in glacial outwash deposits derived mainly from sandstone and shale. These soils are nearly level and are in depressions on stream terraces. The areas are in the southern half of the county.

In a representative profile, in an uncultivated area, the surface layer is very dark gray gravelly loam 3 inches thick. The subsoil, to a depth of about 22 inches, is very friable or friable gravelly loam that is strongly acid in reaction. It ranges from mottled yellowish brown in the upper part to mottled grayish brown in the lower part. Mottling increases with depth. From a depth of 22 down to 28 inches, the lower part of the subsoil is grayish brown, friable gravelly sandy loam that is distinctly mottled. The substratum is gray, loose very gravelly loamy sand that extends to a depth of 50 or more inches. It is stratified, and it is strongly acid.

Red Hook soils have a seasonal high water table near the surface in spring. Runoff and underground seepage from higher adjacent areas commonly collect on this soil. Rooting depth depends on the fluctuating water table, but it normally is 15 to 20 inches. Available water capacity is low, but lack of moisture is seldom a limitation. Permeability is dominantly moderate to rapid, but in places the soils are slowly permeable deep in the substratum. Natural fertility is medium. Lime needs are high. If adequately drained and fertilized, these soils are suitable for crops.

Representative profile of Red Hook gravelly loam in a recreational area, one-half mile west of the village of Gainesville; 800 feet north of Shearing Road, one-half mile west of its junction with State Route 19:

A1—0 to 3 inches, very dark gray (10YR 3/1) gravelly loam; moderate, fine, granular structure; very friable; many fine and medium roots; 25 percent gravel; strongly acid; clear, wavy boundary.

B21—3 to 7 inches, yellowish-brown (10YR 5/6) gravelly loam; few, medium, distinct, grayish-brown (10YR 5/2) mottles; very weak, fine, subangular blocky structure; very friable; common fine and medium roots; few pores; 25 percent gravel; strongly acid; clear, smooth boundary.

B22—7 to 14 inches, brown (10YR 5/3) gravelly loam; many fine, distinct, yellowish-brown (10YR 5/4) and few, fine, faint, grayish-brown (10YR 5/2) mottles; weak, fine, subangular blocky structure; very friable; many fine and medium roots; few pores; 30 percent coarse gravel; strongly acid; clear, smooth boundary.

B23—14 to 22 inches, grayish-brown (10YR 5/2) gravelly loam; many, medium, distinct, yellowish-brown (10YR 5/4) and strong-brown (7.5YR 5/6) mottles; very weak, medium, platy structure; firm in place, friable to crush; few roots; few pores; 30 percent gravel; strongly acid; clear, smooth boundary.

B3—22 to 28 inches, grayish-brown (10YR 5/2) gravelly sandy loam; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; single grain; friable; few pores; 30 percent gravel; strongly acid; clear, smooth boundary.

IIC—28 to 50 inches, gray (10YR 5/1) very gravelly loamy sand; stratified; single grain; loose; 50 percent coarse fragments; strongly acid.

The solum ranges from 20 to 40 inches in thickness. Texture above a depth of 20 inches includes gravelly sandy loam, gravelly loam, sandy loam, and loam.

The Ap horizon ranges from 6 to 9 inches in thickness in cultivated areas. It has a hue of 2.5Y to 7.5YR, a value of 3 to 5, and a chroma of 2 or 3 when moist.

The B horizon has a hue of 2.5Y to 7.5YR, a value of 4 to 6, and a chroma dominantly of 3 to 6 in the upper part. Chroma decreases with depth and becomes 2 or less at a depth of less than 20 inches. Mottles are throughout the B horizon. Reaction in the upper part of this horizon is strongly acid to very

strongly acid, but in places it is medium acid at a depth of 40 inches. Also, it is medium acid or neutral at a depth of more than 40 inches in places. The B horizon is structureless or has weak blocky or weak platy structure that varies with texture.

In the C horizon texture ranges from fine to coarse, and the material is gravel free to very gravelly. This horizon has a hue of 5Y to 7.5YR, a value dominantly of 4 or 5, and a chroma of 1 or 2. It is massive or single grain.

Red Hook soils are associated in a drainage sequence with the moderately well drained Castile soils and the well drained to somewhat excessively drained Chenango soils that formed in similar material. Red Hook soils are on the same kind of landscape as Homer and Wallington soils. They are more acid than Homer soils, and they lack the fragipan and the gravel-free, silty profile of Wallington soils. These soils are commonly near wetter and less acid Halsey soils on terraces and Papakating soils that formed in thick silty alluvium underlain by gravel and sand.

Red Hook gravelly loam (Rh).—This soil has the profile described as representative for the series. It is nearly level and is in low-lying gravelly areas near the streams and depressional areas on better drained outwash terraces. In places this soil receives considerable amounts of surface and subsurface water from adjacent soils. Individual areas are quite variable in size and shape, and range from 5 to 25 acres.

Included with this soil in mapping, in areas adjacent to streams, were small areas of wetter Papakating soils on flood plains. Also included were areas of wetter Halsey soils in lower lying areas and drier Castile soils on slight rises on stream terraces.

Drained areas of this Red Hook soil are suited to crops, mainly those associated with dairying and cash-crop farming. Undrained areas are better suited to water-tolerant hay, grain, and legumes or to some trees. A prolonged seasonally high water table limits the use of this soil. In many places adequate drainage outlets are hard to establish. In a few areas that are adjacent to streams, occasional flooding or inundation is a limitation. Capability unit IIIw-1; woodland suitability group 3w4.

Rock Outcrop

Rock outcrop (Ro) is very steep. It is made up mainly of gorges that dissect the plateau, such as the Letchworth Park Gorge. Typically this land encloses a gorge with almost perpendicular walls of rock outcrop facing each other. Between the base of the rock outcrop and the stream below is a zone of talus or rock and an accumulation of soil rubble that has steep slopes. In Letchworth Park one side wall and talus accumulation is in Wyoming County, and the opposite wall is in Livingston County. The height of the side walls, or depth of most gorges, ranges from 10 to about 200 feet to more than 500 feet in parts of the Letchworth Gorge.

Included with this unit in mapping were a few small areas of steep Bath, Lordstown, and Manlius soils. In Letchworth Park a few tributary valley gorges overhang the main gorge.

The gorges of this unit provide some breathtaking views. In Letchworth Park the adjacent, more gently sloping soils have been developed into various park facilities. Scattered stands of timber cling to ledges and talus areas of this unit, but steepness makes it impossible to manage the stand. The recreational potential is about the only feasible use. Capability unit, not assigned; woodland suitability group, not assigned.

Scio Series

The Scio series is made up of deep, moderately well drained, medium-textured soils that formed in thick silty deposits of old alluvium or material of eolian origin. These soils are nearly level to gently sloping and are on stream terraces or old alluvial fans.

In a representative profile, the surface layer is dark grayish-brown silt loam 9 inches thick. The subsoil from a depth of 9 down to 31 inches, is yellowish-brown, friable silt loam. The lower part, from a depth of 19 down to 31 inches, is distinctly mottled. The substratum, from a depth of 31 down to 40 inches, is brown, friable, mottled silt loam. The surface layer, subsoil, and substratum have few or no coarse fragments. They are strongly acid in unlimed areas. The surface layer of a representative profile in a limed area is medium acid. From a depth of 40 down to 50 inches or more is grayish-brown, loose very gravelly loamy sand that contrasts with the upper silty part. It is distinctly mottled and is medium acid.

Scio soils have a temporary high water table at a depth of 18 to 24 inches in seasonally wet periods. The rooting depth is mainly 24 to 30 inches. Available water capacity is moderate to high. Permeability is moderate in the subsoil and ranges from rapid to slow in the substratum, depending on the contrasting material. Natural fertility is low. These soils are very well suited to row crops, because crops respond well to large applications of lime and fertilizer. They are well suited to crops that require the use of soil-penetrating harvesting equipment.

Representative profile of Scio silt loam in a pasture in the town of Pike, 2 miles north of the village of Pike, west side of Campbell Road, seven-tenths mile north of intersection with Safford Road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; many fine roots; medium acid; abrupt, smooth boundary.

B21—9 to 19 inches, yellowish-brown (10YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; common medium and fine pores; strongly acid; clear, wavy boundary.

B22—19 to 31 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct, strong-brown (7.5YR 5/6) and faint, light brownish-gray (10YR 6/2) mottles; weak, fine, subangular blocky structure; friable; few fine roots; common medium and fine pores; strongly acid; clear, smooth boundary.

C1—31 to 40 inches, brown (10YR 5/3) silt loam; many, medium, distinct, yellowish-brown (10YR 5/8) and gray (10YR 6/1) mottles; very weak, thick, platy structure; friable; common medium and fine pores; 3 percent coarse fragments; strongly acid; abrupt, smooth boundary.

IIC2—40 to 50 inches, grayish-brown (2.5Y 5/2) very gravelly loamy sand; common, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; 35 percent gravel; medium acid.

The solum ranges from 24 to 36 inches in thickness. Contrasting texture is at a depth of 40 inches to 6 feet. Bedrock is at a depth of 6 feet or more. The solum ranges from silt loam to very fine sandy loam. Reaction ranges from very strongly acid to strongly acid. The solum has a hue of 7.5YR to 2.5Y.

The A horizon has a value of 3 to 5 and a chroma of 2. The B horizon has a value of 4 or 5 and a chroma of 3 to 6. The C horizon has a chroma of at least 1 unit less than that of the B horizon. This horizon has weak platy structure or is massive.

Scio soils are in landscapes similar to those of the Castile, Herkimer, and Phelps soils. They lack the coarse fragments at a depth of less than 40 inches that are in the Castile, Herkimer, and Phelps soils, and they are more acid than Herkimer and

Phelps soils. Scio soils are near drier Allard and Chenango soils and wetter Red Hook and Wallington soils. They have a thicker silt mantle over gravel than Allard soils, and they lack the fragipan of Wallington soils. Scio soils, unlike Chenango and Red Hook soils, do not have gravel in the solum.

Scio silt loam, 0 to 3 percent slopes (ScA).—This soil has the profile described as representative for the series. It is nearly level and is on silty stream terraces or near the outer margins of old alluvial fans in the southern part of the county. It receives some runoff from adjacent soils in places, but the internal drainage commonly is controlled by the water table that is part of a valley floor groundwater basin. Most individual areas are roughly rectangular or irregular in shape and are 10 to 50 acres in size.

Included with this soil in mapping were a few areas of soils that are shallower than 40 inches to gravel. In the upper Oatka and Tonawanda valleys, some similar soils that have a somewhat higher reaction than is normal for Scio soils were also included.

This Scio soil is suited to most crops commonly grown in the county. Row crops, such as potatoes, grow very well. Potatoes, dry beans, and crops used in support of dairying are the main crops. Lime and fertilizer needs generally are high. Seasonal wetness delays planting briefly in places. If this soil is on fans, the hazard of flooding is very slight. Use of mechanical harvesters is not restricted by stones. Capability unit IIw-1; woodland suitability group 2o1.

Scio silt loam, 3 to 8 percent slopes (ScB).—This soil has a profile similar to the one described as representative for the series, except that the subsoil is slightly darker in color, and it contains a few shale chips in places. This gently sloping soil is on silty fans where deeply dissected tributary valleys merge with larger valleys in the southwestern part of the county. This soil commonly is at the fan apex, and the nearly level Scio soils are near the fan margins. The streams that deposited these fans drain upland areas dominated by Erie, Fremont, and Langford soils. Individual areas range from 10 to 40 acres in size.

Included with this soil in mapping were areas of well-drained Allard soils that have shaly silt loam layers in the subsoil and substratum.

Most areas of this Scio soil are cleared and are used for crops used in dairying. Seasonal wetness delays planting briefly in places, and flash flooding is a slight hazard. The hazard of erosion is moderate to severe if this soil is cultivated and not protected. Capability unit IIe-5; woodland suitability group 2o1.

Sun Series

The Sun series is made up of deep, very poorly drained to poorly drained, nearly level soils that formed in a thin, slightly acid, stone-free, medium-textured mantle and underlying calcareous glacial till. These soils are in flat or slightly depressional areas of the plateau.

In a representative profile the surface layer is very dark gray silt loam 9 inches thick. The upper part of the subsoil, to a depth of 21 inches, is gray, friable very fine sandy loam that is distinctly mottled but is dominantly gray. The surface layer and the upper part of the subsoil are slightly acid and contain no coarse fragments. From a depth of 21 down to 31 inches, the lower part of the subsoil is friable, grayish-brown gravelly light loam that contains many distinct mottles. Reaction is neutral in this part of the subsoil. From a depth of 31 down to 50 inches or more, the substratum is brown gravelly light loam that is calcareous. It is distinctly mottled and is firm.

Sun soils have a seasonally high water table at or near the surface that remains until May or early in June unless the soils are artificially drained. These soils receive runoff water from adjacent higher soils and are commonly ponded in very wet periods. In undrained areas the rooting depth is restricted mainly to the surface layer most of the year. As the water table recedes or if these soils are drained, root depth is greater. Available water capacity is moderate to high. Permeability is moderate in the surface layer and subsoil and moderately slow or slow in the substratum. Nitrogen levels are high. Potassium and phosphorus reserves are low to medium, and need for lime generally is low. The prolonged wetness of this soil is the main limitation for farming.

Representative profile of Sun silt loam in a cultivated field in the town of Perry, on Coe Road, 800 feet north of U.S. Highway 20A, on the east side of Coe Road:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) when dry; fine granular structure; very friable; many fine roots; many medium and fine pores; slightly acid; abrupt, smooth boundary.

B21g—9 to 21 inches, gray (10YR 5/1) very fine sandy loam; common, fine and medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common roots in upper part, few in lower; few fine pores; slightly acid; gradual, wavy boundary.

IIB22—21 to 31 inches, grayish-brown (10YR 5/2) gravelly light loam; many, medium, distinct, brown (10YR 4/3) and yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; friable; few fine roots in upper part; few fine pores; 15 percent gravel; neutral; clear, wavy boundary.

IIC—31 to 50 inches, brown (10YR 5/3) gravelly light loam; common, medium, distinct, yellowish-brown (10YR 5/6) and few grayish-brown (10YR 5/2) mottles; weak, thick, platy structure; firm; few pores; 20 percent coarse fragments; calcareous; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. Carbonates are at a depth of 20 to 70 inches. Bedrock is at a depth of 40 inches to 20 feet or more. The upper horizons of some profiles are influenced by local alluvium, with thickness ranging from 10 to 24 inches. The content of coarse fragments ranges from zero to 20 percent. The solum has a hue of 7.5YR to 2.5Y.

The A horizon has a value of 2 or 3 and a chroma of 1 or 2. It ranges from medium acid to neutral.

The B horizon has a value of 4 to 6 and a chroma dominantly of 1 in the upper part and a chroma of more than 2 in some parts at a depth of less than 30 inches. This horizon ranges from sandy loam to loam.

The C horizon is dominantly loam and is 15 to 35 percent coarse fragments. This horizon generally is calcareous.

Sun soils are on similar kinds of landscapes and are commonly near the Alden, Ellery, Ilion, and Lyons soils. They lack the fragipan of Ellery soils, and they contain less clay in the B horizon than Alden, Ilion, or Lyons soils. Sun soils lack the mucky A horizon of Alden soils. They are near Appleton and Dalton soils that are somewhat poorly drained, but they have a B horizon that contains less clay than these soils.

Sun silt loam (Su).—This is the only Sun soil mapped in the county. It is nearly level and is in small, irregular pockets surrounded by better drained soils or in long narrow strips along drainageways. Individual areas range from 10 to 20 acres in size.

Included with this soil in mapping were spots of Alden, Appleton, Dalton, Ellery, and Lyons soils. Areas of Alden soils that have a mucky surface layer are indicated on the soil map by the symbol for wet spot or drainageways. Drier Appleton soils were included in mapping in the northern part of the county along with similar, but finer textured, Lyons soils. Also included were somewhat poorly drained Dalton soils in adjacent areas to the south. Ellery soils are similar, but they are finer textured and have a fragipan.

Undrained areas of Sun soils are suited mainly to pasture or trees. If adequately drained and properly managed, this soil is suited to most crops commonly grown in the county, including cash crops. This soil is well suited to pond sites and wildlife marshes. Capability unit IVw-2; woodland suitability group 4w2.

Teel Series

The Teel series is made up of deep, moderately well drained to somewhat poorly drained, medium-textured soils that are slightly acid to neutral. These nearly level soils are along the large meandering creeks and rivers in the northern half of the county. They formed in alluvium.

In a representative profile the surface layer is very dark grayish-brown silt loam 10 inches thick. The subsoil is friable silt loam that is neutral in reaction and that extends from a depth of 10 down to 38 inches. The upper part, from a depth of 10 down to 18 inches, is dark grayish-brown. The middle part, from a depth of 18 down to 24 inches, is brown to dark brown with grayish-brown mottles. The lower part, from a depth of 24 down to 38 inches, is grayish brown with faint and distinct mottles. The substratum, to a depth of 60 inches or more, is friable, dark grayish-brown silt loam that is faintly mottled and neutral.

Teel soils are subject to annual flooding and remain under water from 2 to 4 days in places. The water table is governed by the water level of the adjacent stream and persists at a depth of 18 to 24 inches for significant periods. During the growing season, rooting depth extends to a depth of 30 inches or more in places. Permeability is moderate in the root zone. Available water capacity is high. Reserves of nitrogen, phosphorus, and potassium are medium. Lime needs are low. These soils respond well to management and are easy to manage. Seasonal wetness and the hazard of flooding are the main limitations to use.

Representative profile of Teel silt loam in a cultivated field in the town of Middlebury, three-tenths mile east of junction of School Road and State Route 19, 40 feet south of School Road:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam, gray to light gray (10YR 6/1) when dry; moderate, medium, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

B21—10 to 18 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; common fine and medium roots; many fine pores; neutral; gradual, smooth boundary.

B22—18 to 24 inches, brown to dark-brown (10YR 4/3) silt loam; common, medium, faint, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; common roots; many fine pores; neutral; clear, smooth boundary.

B3—24 to 38 inches, grayish-brown (10YR 5/2) silt loam; common, fine, faint, yellowish-brown (10YR 5/4) and distinct brown (7.5YR 5/4) mottles; very weak, coarse, prismatic structure; friable; few roots in upper part; many fine pores; neutral; gradual, smooth boundary.

C—38 to 60 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, faint, dark yellowish-brown (10YR 4/4) mottles; massive; friable; common fine pores; neutral.

The solum ranges from 24 to 40 inches in thickness. Carbonates are at a depth of more than 40 inches. Bedrock is at a depth of more than 6 feet. The solum ranges from slightly acid to neutral in the upper part and from neutral to mildly alkaline in the lower part. It is dominantly silt loam but ranges to fine sandy loam. Coarse fragments generally are absent. The solum has a hue of 7.5YR to 2.5Y, a value of 3 to 5, and a chroma of 2 or 3.

The B horizon has very weak to moderate subangular blocky or prismatic structure.

The C horizon is similar to the B horizon in texture. Distinct mottles are in this horizon. It generally is massive or has platy structure. Reaction ranges from neutral to mildly alkaline.

Teel soils are closely associated on flood plains with well drained Hamlin soils and the wetter Wallkill and Wayland soils. They are also near shaly, well drained to moderately well drained Herkimer soils on adjacent alluvial fans.

Teel silt loam (Te).—This is the only Teel soil mapped in the county. It is nearly level and is on the flood plains of the larger streams. Individual areas occupy narrow strips within the flood plains and generally are 10 to 50 acres in size. It is subject to annual flooding, generally early in spring.

Included with this soil in mapping were areas of Hamlin, Herkimer, and Wayland soils. Hamlin soils were on thicker and slightly elevated deposits near the stream. Wetter Wayland soils were in depressions and low areas along the flood plain, and they receive seepage water from higher adjacent soils. Also included, along the fringe areas of Herkimer fans, were some areas of Teel soils that have coarse fragments in the substratum. Areas of soils that are slightly wetter than this one were also included.

This Teel soil is very well suited to crops because it is easy to cultivate and is free of stones. It is used mainly for cash crops and crops used in support of dairying. Natural fertility is high. Periodic flooding and a seasonal high water table are the major limitations to use. Where artificial drainage is needed, outlets are difficult to establish. Streambank erosion is a hazard in some areas. This soil is an excellent source of topsoil. Capability unit IIw-4; woodland suitability group 2o3.

Tioga Series

The Tioga series is made up of deep, well-drained, medium-textured soils that formed in alluvium. These nearly level soils are on flood plains along the larger tributary streams in the narrower valley areas. Reaction in these soils is dominantly medium acid.

In a representative profile the surface layer is very dark grayish-brown silt loam 9 inches thick. The subsoil, to a depth of 24 inches, is brown, friable, medium acid silt loam. The upper part of the substratum, from a depth of 24 down to 42 inches, is dark grayish-brown, friable, slightly acid silt loam. It has some mottling. Between depths of 42 and 50 inches or more, the lower part of the

substratum is grayish-brown very gravelly loamy sand that is slightly acid.

Tioga soils are subject to occasional flooding. The water table generally is at a depth of more than 2 feet, except during periods of flooding. It is governed by the water level of the adjacent streams. Rooting depth generally is unrestricted. Available water capacity is high. Permeability is moderate in the silty part and rapid in the underlying sand and gravel. Natural fertility is medium. These soils respond well to good management. Flooding is the main limitation for farming, but it rarely occurs during the growing season.

Representative profile of Tioga silt loam in a cultivated area 1½ miles southeast of village of Arcade, 100 feet north of Bray Road, 500 feet east of its junction with State Route 98:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) crushed and dry; moderate, medium, granular structure; friable; many fine roots; medium acid; clear, smooth boundary.

B—9 to 24 inches, brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; common fine roots; many fine roots; medium acid; clear, smooth boundary.

C1—24 to 42 inches, dark grayish-brown (10YR 4/2) silt loam; few, medium, distinct, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) mottles; massive; friable; few fine roots; porous; slightly acid; clear, wavy boundary.

IIC2—42 to 50 inches, grayish-brown (10YR 5/2) very gravelly loamy sand; single grain; loose; stratified; slightly acid.

The solum ranges from 15 to 30 inches in thickness. Gravelly layers are at a depth of more than 40 inches. Coarse fragments are lacking or few between depths of 10 to 40 inches. The solum is strongly acid or medium acid in the upper 20 inches and is slightly acid or neutral at a depth of less than 40 inches.

The Ap horizon has a hue of 10YR to 2.5Y, a value of 3 to 5, and a chroma of 2 or 3.

The B horizon has a hue of 2.5Y to 7.5YR, a value of 4 or 5, and a chroma of 2 to 4. This horizon lacks mottles to a depth of 30 inches. It is silt loam, fine sandy loam, or loam and has very weak to weak, blocky or moderate, granular structure. Consistence is very friable to friable.

Tioga soils are similar to and near Allard soils, which are on higher stream terraces that do not flood. They lack the sandy or gravelly C horizon within a depth of 20 to 40 inches of the surface that is characteristic of Allard soils. These soils are similar to Hamlin soils but are more acid in the upper 20 inches. They are commonly near wetter Papakating and Wayland soils on flood plains.

Tioga silt loam (Tg).—This is the only Tioga soil mapped in the county. It is nearly level and is on flood plains adjacent to streams in the southern part of the county. These streams drain the more acid uplands of the plateau. Individual areas range from 20 to 50 acres or more in size.

Included with this soil in mapping were small areas of similar, but moderately well drained, soils along outer margins of the flood plain. Also included were many spots where stratified sand and gravel is within a depth of 20 to 40 inches.

Most areas of this Tioga soil are cleared and farmed at a rather high level of intensity. Potatoes, corn, grain, and hay are the main crops. This soil has no surface stones, so tillage and harvesting operations are not restricted. Streambank erosion is a hazard in places. Capability unit I-2; woodland suitability group 2o3.

Tuller Series

The Tuller series is made up of shallow, somewhat poorly drained and poorly drained, medium-textured soils. These soils are strongly acid. They formed in mixed sandstone and shale till. They are nearly level to gently sloping and are on uplands associated with Arnot and Lordstown soils, mainly in an area extending from the central through the northern and northwestern parts of the county.

In a representative profile the surface layer is very dark grayish-brown channery silt loam 8 inches thick. The subsurface layer is 2 inches of distinctly mottled, light brownish-gray channery silt loam. The subsoil, from a depth of 10 down to 17 inches, is friable, distinctly mottled, dark grayish-brown very channery silt loam. The surface and subsurface layers and the subsoil are strongly acid. Hard, grayish-brown sandstone bedrock is at a depth of 17 inches.

Tuller soils have a seasonally high water table. The rooting depth is confined to the 10 to 20 inches above the bedrock. The plow layer is porous but contains many flat stone fragments that interfere with tillage operations in places. Available water capacity generally is low to very low but varies with the depth to bedrock. Permeability is moderate in the soil mantle. Lime needs are high for most crops. Natural fertility is low to medium.

Representative profile of Tuller channery silt loam, 3 to 8 percent slopes, in a cultivated field in the town of Bennington, 2½ miles southeast of village of Bennington, near junction of Hoover and French Roads:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) channery silt loam; moderate, medium, granular structure; friable; many fine roots; 30 percent coarse fragments; strongly acid; abrupt, smooth boundary.

A2g—8 to 10 inches, light brownish-gray (10YR 6/2) channery silt loam; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; common fine roots; 35 percent coarse fragments; strongly acid; clear, wavy boundary.

B2g—10 to 17 inches, dark grayish-brown (2.5Y 4/2) very channery silt loam; many, medium, distinct, light brownish gray (10YR 6/2) and yellowish-brown (10YR 5/8) mottles; weak, medium, subangular blocky structure; firm; few fine roots; 40 to 45 percent coarse, fragments; strongly acid; abrupt, smooth boundary.

R—17 inches +, hard grayish-brown sandstone.

The solum thickness ranges from 10 to 20 inches and corresponds with the depth to bedrock. The content of coarse fragments, mainly flat sandstone, ranges from 35 to 50 percent The solum ranges from very strongly acid to strongly acid. It has a hue of 10YR or 2.5Y.

The Ap horizon has a value of 3 or 4 and a chroma of 2 or 3.

The A2 horizon, if present, has a chroma of 2 or less and a value of mainly 6. Mottles are few to many and distinct. The A2 horizon is loam or silt loam.

The B horizon has a value of 4 or 5 and a chroma of 2 or 3. Ped faces have a chroma of 2 or less. Mottles are few to many and distinct. This horizon has weak to moderate subangular blocky to weak prismatic structure. It is loam or silt loam.

The underlying bedrock is mainly fractured sandstone that is commonly interbedded with shale.

Tuller soils are commonly associated with the moderately well drained to well drained, shallow Arnot soils and the moderately deep, well drained Lordstown soils that formed in similar material. Tuller soils are also near Ellery, Erie, and Volusia soils. These soils are deeper than Tuller soils, and they have a fragipan, which is lacking in Tuller soils.

Tuller channery silt loam, 0 to 3 percent slopes (TuA).—This soil has a profile similar to that described as representative for the series, but runoff generally is slower,

and wetness is more evident in some places. The latter is indicated by mottling and more gray colors below the surface layer. This soil is nearly level and occupies the areas of the upland till that are commonly slight depressions or flat tabletops. It commonly receives subsurface seepage from adjacent higher sandstone bedrock. Individual areas are irregular in shape and range from 5 to 25 acres or more in size.

In most areas of this soil, bedrock is at a depth of less than 20 inches. Small areas where bedrock is deeper, however, were included in mapping. Also included were areas of drier Arnot and Lordstown soils on slight rises.

About half of this Tuller soil is wooded, and the rest is in pasture or is idle. Unless drained, this soil is better suited to water-tolerant hay or pasture mixtures than to cultivated crops. Drainage outlets and tile installations are difficult to establish because of bedrock. Very little of this soil is tilled. Capability unit IVw–1; woodland suitability group 5w1.

Tuller channery silt loam, 3 to 8 percent slopes (TuB).—This soil has the profile described as representative for the series. It is gently sloping and is in areas of the upland till. This soil generally receives considerable amounts of surface runoff or subsurface seepage from upper adjacent areas. Individual areas are irregular in shape and range from 5 to 20 acres or more in size.

This soil generally is less than 20 inches thick to bedrock. Small areas where the soil is deeper, however, were included in mapping. Also included were a few ledges of bedrock that protrude through the soil surface. These were indicated on the soil map by the symbol for bedrock escarpment. Also included were spots of drier Arnot and Lordstown soils on slight rises.

Most of this Tuller soil is in woods, pasture, or is idle. It is limited in use for crops because of the shallowness to bedrock and the difficulty in establishing adequate drainage. Large applications of fertilizer and lime are needed if this soil is used for crops. Coarse fragments interfere with some tillage operations in places. Capability unit IVw–1; woodland suitability group 5w1.

Valois Series

The Valois series is made up of deep, well-drained soils on loamy glacial till that, in places, is underlain by gravelly glacial outwash. These soils are nearly level to moderately steep and have irregular slopes. They are on ablation moraines in an area bounded by the villages of Warsaw and Silver Springs on the east and Varysburg, North Java, and Bliss on the west.

In a representative profile, in a cultivated area, the surface layer is dark grayish-brown gravelly loam about 9 inches thick. The upper part of the subsoil is strongly acid, friable gravelly loam that is strong brown from a depth of 9 down to 18 inches and yellowish brown at depths between 18 and 25 inches. The lower part of the subsoil, from 25 down to 45 inches, is brown, firm gravelly loam that is strongly acid. From a depth of 45 down to 56 inches, the subsoil is firm, brown gravelly sandy loam that is medium acid. The substratum is friable to loose, grayish-brown, medium acid, very gravelly sandy loam ablation till that extends to a depth of 70 inches or more.

Valois soils are strongly acid and have medium to low natural fertility. These soils respond well to applications of lime and fertilizer. The surface layer and subsoil have good aeration and drainage. Available water capacity is moderate. Permeability is moderate to moderately rapid in the root zone. The rooting depth is mainly 30 inches.

Representative profile of Valois gravelly loam, 3 to 8 percent slopes, in a cultivated field in the town of Orangeville, 4 miles west of village of Warsaw, one-half mile west of junction of Centerline and Hermitage Roads, 100 yards south of Centerline Road near a gravel pit:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam; moderate, medium, granular structure; very friable; many fine roots; 25 percent coarse fragments; strongly acid; abrupt, smooth boundary.

B21—9 to 18 inches, strong-brown (7.5YR 5/6) gravelly loam; weak; fine, subangular blocky structure; very friable; many fine roots; 20 percent coarse fragments; many fine and medium pores; strongly acid; clear, wavy boundary.

B22—18 to 25 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, fine, subangular blocky structure; friable; common fine roots; many fine pores; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

B23—25 to 45 inches, brown (10YR 5/3) gravelly loam; weak, medium, platy structure; firm in place, very friable to crush; common fine roots in upper part, few in lower part; many fine pores; 20 percent gravel; strongly acid; gradual, smooth boundary.

B24—45 to 56 inches, brown (10YR 5/3) gravelly sandy loam; very weak, medium and coarse, subangular blocky structure; firm in place, friable to crush; porous; 30 percent gravel; medium acid; clear, wavy boundary.

IIC—56 to 70 inches, grayish-brown (10YR 5/2) very gravelly sandy loam; single grain; loose; porous; 60 percent gravel; stratified below depth of 65 inches; medium acid.

The solum ranges from 40 to 65 inches in thickness. Bedrock is at a depth of 40 inches or more and commonly is in the range of 30 to 100 feet. The content of coarse fragments, by volume, ranges from 5 to 25 percent in the upper part of the solum and from 20 to 35 percent in the lower part. The solum ranges from sandy loam to silt loam to a depth of 40 inches and has very weak or weak, very fine to medium, subangular blocky structure, but it is platy in the lower part in places. Consistence is very friable to firm in places but is friable when removed. Patchy clay films are on some peds. The solum is strongly acid or very strongly acid to a depth of 40 inches.

The Ap horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 2 or 3.

The B horizon has a hue of 7.5YR to 2.5Y, a value of 4 or 5, and a chroma of 3 to 8. The higher chroma is in the upper part.

The C horizon has a hue of 10YR or 2.5Y, a value of 4 to 6, and a chroma of 2 or 3. This horizon ranges from loam to sandy loam. Below a depth of 40 inches, the content of coarse fragments, by volume, ranges from 20 to as much as 70 percent in individual layers. This horizon ranges from strongly acid to neutral, and it is weakly calcareous at a great depth in places.

Valois soils are intermingled with Bath soils in morainic areas, and they are mapped only with these soils. Valois soils lack the fragipan and firm basal till substratum of Bath soils. Valois soils are commonly near wetter Dalton, Erie, and Volusia soils that are commonly at lower elevations. They occupy similar kinds of landscapes as soils of the Howard-Madrid complex, but they are more acid and have less clay in the B horizon.

Varysburg Series

The Varysburg series is made up of deep, well drained and moderately well drained soils in contrasting deposits. The surface deposit ranges from 20 to 40 inches in thickness and is gravelly or very gravelly loam. Underlying this is a fine-textured, stone-free, silty clay, lacustrine deposit.

These soils are gently sloping to moderately steep and are on terraces or on topography associated with lateral moraine deposits.

In a representative profile the surface layer is dark grayish-brown gravelly loam 7 inches thick. The subsurface layer is strong-brown and yellowish-brown, friable gravelly loam about 10 inches thick. The surface and subsurface layers are 30 to 35 percent rounded gravel. The upper part of the subsoil, from a depth of 17 down to 29 inches, is brown to dark-brown, friable very gravelly loam. It is slightly acid to a depth of 24 inches. Between depths of 24 and 29 inches it is neutral and more sticky because of a slightly higher content of clay. This layer is 35 to 55 percent gravel. The lower part of the subsoil, from a depth of 29 down to 43 inches, is distinctly mottled grayish-brown to brown, firm silty clay that is free of gravel and that is neutral to alkaline. The substratum, from a depth of 43 down to 60 inches or more, is brown silty clay that has thin layers of silty clay loam and silt loam. It is firm and calcareous.

Varysburg soils have a perched water table at a depth of 18 to 30 inches in places during wet periods. The rooting depth is mainly confined to the gravelly surface layer and the upper part of the subsoil. Available water capacity is moderate to low in this zone, and aeration and internal drainage are good. Permeability is slow or very slow in the clayey lower part of the subsoil and the substratum. These soils have low to moderate ability to supply plant nutrients. Potassium reserves and content of lime are high in the lower part of the subsoil.

Representative profile of Varysburg gravelly loam, 2 to 8 percent slopes, in an idle area in the town of Sheldon, 2 miles northeast of village of North Java, near East Fork of Tonawanda Creek:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly loam; moderate, fine, granular structure; very friable; many fine roots; 30 percent gravel; strongly acid; abrupt, smooth boundary.

A21—7 to 12 inches, strong-brown (7.5YR 5/6) gravelly loam; weak, medium, subangular blocky structure that breaks to granular; friable; many fine roots; porous; 30 percent gravel; strongly acid; clear, wavy boundary.

A22—12 to 17 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, fine and medium, subangular blocky structure; friable; common fine roots; porous; 35 percent gravel; medium acid; clear, wavy boundary.

B&A—17 to 24 inches, brown to dark-brown (10YR 4/3) very gravelly loam; weak to moderate, fine, subangular blocky structure; friable; few fine and medium roots; many fine pores with clay linings; 35 to 50 percent gravel; coatings of yellowish-brown (10YR 5/4) material, 1 to 5 millimeters thick, on gravel and ped faces; slightly acid; gradual, smooth boundary.

B21t—24 to 29 inches, brown to dark-brown (10YR 4/3) very gravelly loam; weak to moderate, medium, subangular blocky structure; friable; few fine roots; common fine pores with clay linings; clay films on 30 percent of ped faces; 40 to 55 percent gravel; neutral; abrupt, smooth boundary.

IIB22t—29 to 35 inches, grayish-brown (10YR 5/2) silty clay; common, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate, medium, angular blocky structure; firm; common fine pores with clay linings; continuous dark grayish-brown (10YR 4/2) clay films on ped faces; neutral; clear, smooth boundary.

IIB23t—35 to 43 inches, brown (7.5YR 5/4) silty clay; few, fine, faint, strong-brown (7.5YR 5/6) mottles; strong coarse blocks within moderate, medium, prismatic structure; firm; common fine pores with clay linings; peds have brown to dark-brown (10YR 4/3) continuous clay films; mildly alkaline and weakly calcareous; clear, wavy boundary.

IIC—43 to 60 inches, brown (7.5YR 4/2) layers of silty clay, silty clay loam, and silt loam; massive; firm; calcareous; moderately alkaline.

The solum ranges from 35 to 50 inches in thickness. The gravelly mantle over stone-free clay ranges from 20 to 36 inches in thickness. Carbonates generally are at a depth of 40 inches but range from 35 to 60 inches in depth. The solum ranges from strongly acid to medium acid in the upper part and slightly acid to mildly alkaline in the lower part. It is weakly calcareous in the lower part in places. The content of coarse fragments in the A horizon ranges from 15 to 40 percent and increases with depth to as much as 50 or 60 percent in the B21t horizon. The upper part of the mantle is loam or sandy loam. The B&A and B21t horizons have a hue of 10YR or 7.5YR, and hue in the IIBt horizon ranges from 5YR to 5Y.

The Ap horizon ranges from a very dark grayish brown (10YR 3/2) to dark brown (10YR 4/3).

Clay coatings are on 10 to 40 percent of the ped faces in the part of the B horizon that is in the gravelly mantle, and on 25 to 80 percent of the ped faces in the part of the B horizon that is in the underlying silty clay.

Varysburg soils are commonly adjacent to Caneadea and Howard soils on similar kinds of landscapes. They have a clayey horizon in the lower part of the subsoil that is lacking in the well-drained to somewhat excessively drained Howard soils that formed in thick gravelly outwash deposits. Varysburg soils are drier and have a gravelly mantle that is lacking in Caneadea soils.

Varysburg gravelly loam, 2 to 8 percent slopes (VaB).—This gently sloping soil has the profile described as representative for the series. It generally is on the tops of terracelike landforms where it does not receive runoff from adjacent soils. Steeper Caneadea or Varysburg soils are adjacent on the sides of the terraces. Individual areas are roughly rectangular to circular and range from 10 to 50 acres in size.

Included with this soil in mapping were small areas of Howard soils that have a clay substratum at a depth of 3½ to 8 feet. Also included, in small depressions, were spots of wetter Canadice, Caneadea, and Homer soils. Some small areas of nearly level soils were also included.

This Varysburg soil is suited to crops, pasture, or trees. Crops used in dairying are commonly grown. The hazard of erosion is slight if this soil is cultivated and not protected. In places seasonal wetness delays planting briefly. The content of gravel hinders some harvesting operations. Capability unit IIe-4; woodland suitability group 2o2.

Varysburg gravelly loam, 8 to 15 percent slopes (VaC).—This moderately sloping soil has a profile similar to the one described as representative for the series. It is on the sides of terrace-like landforms or in some lateral moraines. It generally receives little or no runoff from adjacent areas. Individual areas are long and narrow on terrace sides or are irregular in shape on lateral moraines. They range from 10 to about 30 acres in size.

Included with this soil in mapping were small areas of Howard soils that have a clayey substratum. Also included were small areas of Caneadea soils that are gravelly in the surface layer and upper part of the subsoil because of an erratic pattern of thickness of the gravel mantle. In addition, areas of soils along valley sides that have a sloughed till mantle rather than gravelly outwash were included. Also, a few seep spots are scattered throughout.

This Varysburg soil is suited to crops, pasture, or trees. It is commonly used for hay and pasture crops. Corn is planted occasionally in the cropping system. The hazard

of erosion is moderate to severe if this soil is cultivated and not protected. In places seep spots need drainage. The use of heavy equipment is difficult and hazardous on the steeper soils. Capability unit IIIe-4; woodland suitability group 2o2.

Varysburg gravelly loam, 15 to 25 percent slopes (VaD).—This soil is moderately steep and is on the sides of some terracelike landforms or on lateral moraines at the valley sides. Individual areas are long and narrow along the sides of terrace landforms or irregular in shape on lateral moraines. They range from 15 to 40 acres in size.

Included with this soil in mapping were small areas of gravelly surfaced Caneadea soils. Also included, on the lateral moraines, were a few areas of Howard soils that have a clay substratum. Other inclusions, along valley sides, were spots of soils that have a mantle of sloughed till over the clay instead of gravelly outwash. Seep spots are commonly scattered throughout the areas.

This Varysburg soil is suited to and used for hay, pasture, or trees. Large areas are idle. Steepness, the hazard of erosion, and the many seep spots are the main limitations to farming. Slopes tend to be irregular, especially in the lateral moraine areas. Capability unit IVe-5; woodland suitability group 2r3.

Volusia Series

The Volusia series is made up of deep, somewhat poorly drained, medium-textured soils. These soils formed in glacial till derived mainly from sandstone and shale. They have a strongly expressed fragipan at a depth of 10 to 18 inches. Volusia soils are extensive on the till-covered landscapes of the Allegheny Plateau in the southern half of the county. They are nearly level to moderately sloping and are in areas that receive runoff from higher adjacent slopes or in areas where runoff is slow.

In a representative profile the surface layer is very dark grayish-brown channery silt loam 9 inches thick. The subsurface layer, from a depth of 9 down to 14 inches, is grayish-brown channery loam and is moderately acid. It has many distinct mottles. This layer is underlain by a dense fragipan. The upper part, from a depth of 14 down to 25 inches, is very firm, olive-brown channery loam that has faint mottles. The lower part, from a depth of 25 down to 50 inches or more, is extremely firm, dark grayish-brown channery loam that has some faint mottles. Both layers of the fragipan are medium acid.

In these soils the rooting depth is restricted mainly to the 10- to 18-inch zone above the fragipan. Free water generally is found above the fragipan until midspring and after each soaking rain. Available water capacity is slow to moderate in the root zone. Permeability is moderate above the fragipan and very slow in the fragipan and below. Volusia soils have medium capacity for supplying nutrients.

Representative profile of Volusia channery silt loam, 3 to 8 percent slopes, in a cultivated area, 3 miles southeast of the hamlet of Varysburg, alongside Dunham Road, 500 feet west of intersection with Syler Road in the town of Orangeville:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) channery silt loam; weak, fine, granular structure; friable; many fine roots; 20 percent coarse fragments; medium acid; abrupt, smooth boundary.

A2—9 to 14 inches, grayish-brown (10YR 5/2) channery loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, thin to medium, platy structure; friable; few fine roots; common fine pores; 20 percent coarse fragments; medium acid; clear, irregular boundary.

Bx1—14 to 25 inches, olive-brown (2.5Y 4/4) channery loam; few, medium, faint, dark grayish-brown (10YR 4/2) mottles; moderate, coarse, prismatic structure; very firm and brittle; grayish-brown (10YR 5/2) coatings on prisms; few roots between prisms; 25 percent coarse fragments; medium acid; gradual, smooth boundary.

Bx2—25 to 50 inches, dark grayish-brown (10YR 4/2) channery loam; common, faint, gray (10YR 5/1) and yellowish-brown (10YR 5/6) mottles; weak, very thick, platy structure within moderate, very coarse prisms; extremely firm and brittle; few fine pores; few, very thin coatings of clay and silt in pores, none on ped faces; 30 percent coarse fragments; medium acid, slightly acid below a depth of 45 inches.

The solum ranges from 42 to 54 inches in thickness. The upper part of the solum generally is medium acid or strongly acid, unless limed. The lower part of the solum, to a depth of 40 inches, is strongly acid to slightly acid. The Bx horizon is at a depth of 10 to 18 inches, and hard sandstone bedrock is at a depth of 3½ to 20 or more feet.

The fine earth fraction of the A horizon and the upper part of the Bx horizon are mainly loam and silt loam. The lower part of the Bx horizon is mainly loam. The content of coarse fragments, mostly angular fragments, ranges from 5 to 30 percent in the A horizon and the upper part of the Bx horizon and from 15 to 35 percent in the lower part of the Bx horizon.

The A2 horizon has a value of 5 or 6 and a chroma of 2. The Bx horizon has a hue of either 10YR or 2.5Y and a value of 4. It commonly has a chroma of 2 to 4. Consistence in the lower part of the Bx horizon ranges from firm to extremely firm. Most of the distinct mottling is found in the A2 horizon, but some is in the Bx horizon.

Volusia soils are closely associated with well-drained Bath soils, moderately well drained Mardin soils, and poorly drained Ellery soils that have formed in similar material. Volusia soils occupy the same type of position on the landscape and are very similar to Erie soils, but they have a more acid fragipan. Volusia soils are very similar to Dalton and Fremont soils. They lack the silty stone-free horizons above the fragipan, which are characteristic of Dalton soils. The fragipan, which is characteristic of Volusia soils, is lacking in Fremont soils.

Volusia channery silt loam, 0 to 3 percent slopes (VoA).—This nearly level soil has a profile similar to the one described as representative for the series, but it is wetter in places. This soil is in areas where runoff is slow or where considerable runoff is received from upper adjacent soils. Individual areas are very irregular in shape and vary greatly in size.

Included with this soil in mapping were small areas of poorly drained Ellery soils, which are common associates in depressional areas and along drainageways. Also included were some areas of similar Dalton soils that have a silty surface layer and areas of Erie soils that are less acid than this soil. A few areas that have less clay in the subsoil were also included because of similarity and difficulty in separating.

This Volusia soil is suited to crops, pasture, or trees. Drainage is needed for intertilled crops. If this soil is adequately drained and fertilized, it is suited to most crops grown in the area and to selected cash crops. Capability unit IIIw-2; woodland suitability group 3w5.

Volusia channery silt loam, 3 to 8 percent slopes (VoB).—This gently sloping soil has the profile described as representative for the series. It commonly is in areas on

long, broad, smooth or slightly concave slopes where runoff generally is diverted through slight depressional areas, but in some areas moves uniformly over the entire slope.

Included with this soil in mapping were areas of wetter Ellery soils in depressions and along drainageways and areas of somewhat poorly drained Dalton soils that have a thin silt cap over the glacial till. Also included in mapping were small areas of soils that have less clay in the subsoil than this soil and areas of Fremont soils that lack a fragipan.

This soil is suited to such crops as corn and small grains and to hay, pasture, and trees. Wetness limits its suitability for crops early in the season. Plants are adversely affected by lack of moisture during long dry periods. Erosion is a slight hazard if this soil is cultivated and not protected. Capability unit IIIw–6; woodland suitability group 3w5.

Volusia channery silt loam, 8 to 15 percent slopes (VoC).—This moderately sloping soil has a profile similar to the one described as representative for the series, but in places it is better drained. It is in smooth areas that receive runoff from upper adjacent slopes. Individual areas occur as long narrow strips along the valley walls.

Included with this soil in mapping were small areas of better drained Mardin soils. In the south-central part of the county, spots of Fremont soils that lack a fragipan were also included.

This soil is suited to crops, pasture, or trees. Wetness delays planting and limits the selection of crops, and seepage spots interfere with cultivation. Plants are adversely affected by lack of moisture during long dry periods. Erosion is a severe hazard if the soil is cultivated and left unprotected. Capability unit IIIe–9; woodland suitability group 3w5.

Wallington Series

The Wallington series is made up of deep, somewhat poorly drained, medium-textured soils that formed in eolian or lacustrine silt or very fine sand deposits. These soils are nearly level. They are on low positions in valley areas that extend mainly through the southern part of the county.

In a representative profile the surface layer is very dark grayish-brown silt loam 9 inches thick. The subsurface layer, about 5 inches thick, is light brownish-gray light silt loam that has distinct mottles. It is friable and strongly acid. The subsoil, between depths of 14 and 46 inches, is a firm, dark-brown, silt loam, two-layered fragipan that is mottled and strongly acid. The substratum, from a depth of 46 down to 60 inches or more, is grayish-brown light silt loam that has thin strata of loamy very fine sand. It is mottled and medium acid.

The firm, brittle fragipan in these soils restricts downward movement of water. This creates a seasonally high water table within 6 to 18 inches of the surface early in spring and during excessively wet periods. The rooting depth is mainly restricted to the zone above the fragipan. This zone generally ranges from 14 to 18 inches in thickness. Available water capacity in the root zone is moderate. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan and substratum. Natural fertility is medium.

Representative profile of Wallington silt loam (0 to 3 percent slopes), in a cultivated area in the town of Pike, $1\frac{1}{10}$ miles south of the village of Pike, on east side of State Route 19, just south of farm lane to gravel pit:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; very friable; many fine roots; medium acid; abrupt, smooth boundary.

A2—9 to 14 inches, light brownish-gray (10YR 6/2) light silt loam; many, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; very weak, medium, platy structure; friable; common fine roots; strongly acid; abrupt, irregular boundary.

Bx1—14 to 26 inches, dark-brown (10YR 4/3) silt loam; very coarse prismatic structure; thick coatings of light brownish-gray (10YR 6/2) silt on 8- to 14-inch prisms; many, medium, faint, yellowish-brown (10YR 5/4) mottles on interiors of prisms; strong-brown (7.5YR 5/6) borders on prisms; firm and brittle; few roots; strongly acid; gradual, smooth boundary.

Bx2—26 to 46 inches, dark-brown (10YR 4/3) silt loam; weak, thick, platy structure in very coarse prisms; few, fine, faint mottles in prisms and distinct strong-brown (7.5YR 5/6) mottles between matrix and gray (10YR 6/1) prism faces; firm and brittle; strongly acid; gradual, wavy boundary.

C—46 to 60 inches, grayish-brown (10YR 5/2) light silt loam and thin strata of loamy very fine sand; few, fine, faint, light-gray (10YR 6/1) and pale-brown (10YR 6/3) mottles; massive; firm; medium acid.

The solum ranges from 36 to 54 inches in thickness. The upper part of it is medium acid to very strongly acid, and the lower part is strongly acid to slightly acid. The coarse silty deposit is 3½ to 20 feet thick over contrasting material that has coarse fragments. Bedrock is at a depth of 6 feet or more. Generally the solum is less than 2 percent coarse fragments.

The Ap horizon has a hue of 10YR or 7.5YR, a value of 3 or 4, and a chroma of 2. The A2 horizon has a hue of 2.5Y to 7.5YR, a value of 4 to 6, and a chroma of 1 or 2. This horizon has common to many distinct mottles of higher chroma. The A2 horizon is very fine sandy loam to silt loam.

The Bx horizon has a hue of 2.5Y to 7.5YR, a value of 4 or 5, and a chroma of 2 to 4. In this horizon mottles range from few to common, distinct ones that are lower in chroma than the matrix to few to many, fine to coarse, faint to distinct mottles that are higher in chroma than the matrix. The B horizon ranges from silt loam to very fine sandy loam. It is massive, or structure is thick platy within very coarse prisms.

Wallington soils are closely associated with the moderately well drained Williamson soils that formed in similar material. Wallington soils are similar to and generally are near Niagara soils, which have a finer textured B horizon and lack a fragipan. They are similar to the Dalton soils in drainage and in texture of the upper horizons, but Wallington soils lack the contrasting till layer that is within 15 to 36 inches of the surface of Dalton soils.

Wallington silt loam (Wa).—This nearly level to level soil is the only Wallington soil mapped in the county. It is in the low flat areas associated with terraces of old alluvium or in glacial lake basins. Areas of this soil receive some runoff from higher adjacent slopes. Individual areas are small in size, ranging from 10 to 20 acres, and generally are oblong in shape.

Included with this soil in mapping were areas of Niagara soils that occupy similar positions but have a higher clay content in the subsoil and lack a fragipan. Also included were areas of Dalton soils that are similar in texture and drainage but have a contrasting till subsoil. Minor inclusions were small areas that are similar in the upper profile but are underlain with gravel or gravelly layers at a depth of less than 40 inches. Other minor inclusions were small wetter drainageways and wet spots.

This soil is suited to crops, pasture, or trees. Unless this soil is drained, planting is delayed, and the selection of crops is limited. It has a gravel-free surface layer and is

easy to cultivate. If drainage is adequate and fertilizer is properly applied, this soil is suited to most crops grown in the county. Capability unit IIIw–2; woodland suitability group 3w5.

Wallkill Series

The Wallkill series is made up of deep, very poorly drained, medium-textured soils that formed in alluvium over an organic layer. These soils are nearly level. They are in depressional areas of the larger valleys that flood annually.

In a representative profile the surface layer is very dark brown silt loam 2 inches thick. The subsurface layer, to a depth of 6 inches, is very dark gray, friable silt loam that has many, distinct, dark reddish-brown mottles. The upper part of the subsoil, from a depth of 6 down to 15 inches, is dark-gray, friable silt loam that has distinct mottles. The lower part of the subsoil, to a depth of 27 inches, is dark grayish-brown, friable but slightly sticky silt loam that has distinct mottles. It is underlain by black and very dark brown muck that has some partly decomposed woody fragments. The muck extends to a depth of 50 or more inches. Reaction of the soil material is neutral throughout the profile.

These soils are near streams and are flooded each year. Flood water recedes slowly, and the water table is at or near the surface much of the time. Rooting depth generally is in the upper 15 inches unless these soils are drained. Available water capacity is variable. Permeability is moderate in the mineral part of these soils but is variable in the organic material. Natural fertility is medium.

Wetness and flooding severely restrict this soil for most uses.

Representative profile of Wallkill silt loam in a meadow near the town of Middlebury, northeast of the village of Wyoming, 1½ miles east of intersection of Cove Road and State Route 19, in a field 300 feet north of Cove Road:

A11—0 to 2 inches, very dark brown (10YR 2/2) silt loam; few, fine, distinct, dark-brown (10YR 3/3) mottles; moderate, fine, granular structure; very friable; many fine roots; neutral; clear, smooth boundary.

A12—2 to 6 inches, very dark gray (10YR 3/1) silt loam; many, fine, distinct, dark reddish-brown (5YR 3/3) mottles; moderate, medium and coarse, granular structure; friable; many fine roots; porous; neutral; clear, smooth boundary.

B21—6 to 15 inches, dark-gray (5Y 4/1) silt loam; many medium, distinct, dark reddish-brown (5YR 3/4) mottles; moderate, medium, subangular blocky structure; friable; common fine roots; many pores; neutral; gradual, smooth boundary.

B22—15 to 27 inches, dark grayish-brown (10YR 4/2) silt loam, high in content of organic matter; common, medium, distinct, dark reddish-brown (5YR 3/4) mottles, especially along root channels; moderate, fine, subangular blocky structure in weak medium prisms; friable, slightly sticky; common fine roots; porous; neutral; clear, smooth boundary.

IIOa1—27 to 34 inches, black (10YR 2/1) muck, very friable; no roots; porous; neutral; clear, wavy boundary.

IIa2—34 to 50 inches, very dark brown (10YR 2/2) well-decomposed muck that has some partly decomposed woody fragments; very friable; neutral.

The mineral soil over the layer of organic matter ranges from 16 to 40 inches in thickness. The organic layer is at least 20 inches thick. The solum is slightly acid or neutral. All the horizons have a hue in the matrix of 7.5YR to 5Y.

The A horizon has a value of 2 or 3 and a chroma of 1 or 2.

The B horizon has a value of 3 to 5 when moist and of more than 5.5 when dry. Chroma is 1 or 2. This horizon is silt loam, loam, or silty clay loam. The structure of the B horizon is weak prismatic or subangular blocky.

Some profiles have a C horizon that is massive and occurs just above the organic material.

Wallkill soils are associated with the better drained Wayland, Hamlin, and Teel soils on flood plains. Wallkill soils have organic material within a depth of 16 to 40 inches of the surface, but organic material is lacking in the Wayland, Hamlin and Teel soils. In places Wallkill soils are near shaly fans of well drained to moderately well drained Herkimer soils.

Wallkill silt loam (Wk).—This nearly level soil is in flat or depressional areas of flood plains, mainly in the Oatka Valley. It generally is surrounded by such soils as Teel and Wayland on the side nearest the stream and by Herkimer soils on adjacent alluvial fans. Individual areas are large, ranging from 15 to 75 acres or more.

Included with this soil in mapping were small areas of Wayland soils and pockets of muck.

This soil is subject to frequent flooding, and, if undrained, it is not suited to crops. Suitable outlets are difficult to establish. If flooding and drainage are controlled, this soil is suited to intensive cropping. Most areas of this soil are wooded or in swamps, but some areas are in pasture of water-tolerant grasses. During dry seasons this soil is a potential source for topsoil and peat materials. Capability unit IVw–5; woodland suitability group 4w1.

Wayland Series

The Wayland series is made up of deep, poorly drained and very poorly drained, medium-textured soils that formed in alluvium. These soils are nearly level and are in areas along the large meandering creeks and rivers in the northern half of the county.

In a representative profile the surface layer is very dark grayish-brown silt loam 8 inches thick. It has a few faint mottles. The subsoil, to a depth of 25 inches, is dark-gray silt loam that has many distinct mottles. The upper part of the substratum, from a depth of 25 down to 43 inches, is dark-gray, mottled silt loam. All horizons to this depth are neutral. The lower part of the substratum, from a depth of 43 to 50 inches or more, is dark-gray silt loam and very fine sandy loam and is mildly alkaline.

These soils flood frequently. If they are flooded, water recedes from them more slowly than from drier alluvial soils that generally are on slightly elevated levees between this soil and the stream. The water table is at or near the surface for long periods. When the table does recede, these soils have a high available water capacity. Permeability is moderate or moderately slow throughout the profile. Natural fertility is medium to high. Lime needs are low. Wetness and flooding severely limit all the uses of this soil.

Representative profile of Wayland silt loam (0 to 4 percent slopes), in a pasture one-half mile east of the village of Wyoming on south side of Cove Road, just west of the Middlebury-Covington town line, near the town of Middlebury:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; few, fine, faint, very dark yellowish-brown (10YR 3/4) mottles; friable; many fine roots; neutral; clear, smooth boundary.

Bg—8 to 25 inches, dark-gray (10YR 4/1) silt loam; many, fine, distinct, very dark yellowish-brown (10YR 3/4) mot-

tles; weak, coarse, subangular blocky structure; friable; many fine roots; neutral; gradual, smooth boundary.

Clg—25 to 43 inches, dark-gray (10YR 4/1) silt loam; common, medium, distinct, very dark yellowish-brown (10YR 3/4) mottles; massive; friable; common fine roots; neutral; abrupt, wavy boundary.

IIC2—43 to 50 inches, dark-gray (5Y 4/1) stratified silt loam and very fine sandy loam; massive; friable; mildly alkaline.

The silty deposit over other material ranges from 36 to more than 55 inches in thickness. Carbonates are at a depth of 30 to 60 inches. The upper layers of the soil are mainly neutral or mildly alkaline. Bedrock is at a depth of 6 feet or more.

The Ap horizon has a dominant hue of 10YR, a value of 2 to 4, and a chroma of 2.

The Bg horizon has a hue of 2.5Y or 10YR, a value of 3 to 5, and a dominant chroma of 1 or less. Mottles are higher in chroma than the matrix. They range from common to many in abundance. This horizon is mainly silt loam.

Wayland soils are closely associated on flood plains with the better drained Teel and Hamlin soils and the wetter Wallkill soils. Wayland soils are near Palmyra or Phelps soils on glacial outwash terraces. They are associated with Herkimer soils, which are on shaly fans.

Wayland silt loam (Wn).—This nearly level soil is on low-lying flood plains along major streams and in slackwater areas and old oxbows that are partly filled with recent alluvium. Areas occur as long narrow strips on the flood plains and generally range from about 10 to 50 acres in size. These areas are subject to prolonged seasonal flooding.

Included with this soil in mapping were small areas of Canadice, Teel, and Wallkill soils. The Canadice soils formed in lake-laid material. Their subsoil contains more clay than that of this Wayland soil. The Teel soils are moderately well drained. They are on slightly elevated deposits of alluvium that are thicker than the deposits in which this Wayland soil formed. The Wallkill soils are very poorly drained. They formed in alluvium over muck. Also included in mapping, adjacent to Herkimer soils on fans, were small areas of soils similar to this Wayland soil, except that they have coarse fragments in the subsoil and substratum.

This soil is used mainly for pasture or trees. Unless it is drained and protected from flooding, it is not suited to crops. Adequate drainage outlets are difficult to establish in places. Capability unit IVw4; woodland suitability group 4w2.

Williamson Series

The Williamson series is made up of deep, moderately well drained, medium-textured soils that formed in acid lacustrine or aeolian silt and very fine sand deposits or in contrasting channery till deposits over silt and very fine sand. The deep, silty soils are gently sloping to moderately sloping. They are in areas on valley sides, mainly in the towns of Pike and Genesee Falls, but they are also scattered throughout other valley areas of the county. The channery soils are mainly in areas between East Fork Tonawanda Creek and Engine Creek in the towns of Wethersfield and Orangeville and in areas near Portageville on the upper wall of the Genesee Valley.

In a representative profile the surface layer is very dark grayish-brown silt loam 8 inches thick. The upper part of the subsoil, from a depth of 8 down to 15 inches, is yellowish-brown silt loam that is friable and strongly acid. Below this, between depths of 15 and 17 inches, is a distinctly mottled leached layer of pale-brown light silt loam that is strongly acid and friable. The lower part of the subsoil, which is a fragipan that extends from a depth of 17 to 41 inches, is a dark-brown to brown, very firm and brittle silt loam that is distinctly mottled and strongly acid. The substratum, from a depth of 41 down to 50 inches or more, is made up of strata of multicolored silts, very fine sands, and clays that are firm and strongly acid.

In these soils the firm fragipan of the subsoil restricts the downward movement of water causing a temporary high water table early in spring. Rooting depth generally is restricted to the upper 20 inches of the soil. Available water capacity is moderate. Permeability is moderate in the surface layer and upper part of the subsoil and moderately slow or slow in the fragipan and substratum. Natural fertility is medium to low.

Representative profile of Williamson silt loam, 3 to 8 percent slopes, in a cultivated area near the town of Sheldon, 1,000 feet east-northeast of junction of Humphrey Road and U.S. Highway No. 20A:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) uncrushed, dark grayish-brown (10YR 4/2) crushed, silt loam; weak, medium, granular structure; very friable; many fine roots; medium acid; abrupt, smooth boundary.

B2—8 to 15 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; common fine roots; porous; strongly acid; clear, wavy boundary.

A'2—15 to 17 inches, pale-brown (10YR 6/3) light silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, platy structure; friable; few roots; common medium pores; strongly acid; abrupt, irregular boundary.

B'x—17 to 41 inches, dark-brown to brown (10YR 4/3) silt loam; common, medium, faint, yellowish-brown (10YR 5/6) and distinct gray (10YR 6/1) mottles; moderate, coarse, prismatic structure; pale-brown (10YR 6/3) tongues form prism faces; very firm and brittle; few roots in upper part only; strongly acid; clear, smooth boundary.

IIC—41 to 50 inches, colors vary with nature of the material and include horizontal streaks of gray (10YR 6/1), olive-brown (2.5Y 4/4), and yellowish-brown (10YR 5/6) varved silt, very fine sand, and clay; strong, fine and medium, platy structure as a result of varving; firm, strongly acid.

The solum ranges from 40 to 60 inches in thickness. The upper part of the solum is medium acid to very strongly acid, and the lower part is strongly acid to slightly acid. Carbonates, if present, generally are below a depth of 6 feet. The silty deposit ranges from a depth of 40 inches to 30 feet or more. Bedrock is at a depth of 6 feet or more. Generally there are less than 2 percent coarse fragments.

The Ap horizon has a hue of 10YR to 7.5YR, a value of 3 to 5, and a chroma of 2 or 3. It is dominantly silt loam and channery silt loam. The content of coarse fragments ranges from zero to 20 percent.

The B2 horizon has a hue of 2.5Y to 7.5YR, a value of 4 or 5, and a chroma of 3 to 6. In places this horizon has common faint mottles with a chroma of 3 to 6. It is silt loam to very fine sandy loam or channery silt loam or loam.

The A'2 horizon has a hue of 2.5YR to 7.5YR, a value of 5 to 7, and a chroma of 3 or 4. This horizon has common to many, distinct to prominent mottles that have a chroma of 3 to 6. It is massive or has weak platy structure.

The B'x horizon has a hue of 2.5Y to 7.5YR, a value of 4 or 5, and a chroma of 3 or 4. Some A'2 material interfingers into this horizon. Mottles are few to common, medium to coarse, and faint to distinct. Chroma of the mottles ranges from higher to lower than that of the matrix. This horizon is silt loam to

very fine sandy loam. It is massive or has moderate, thick, platy structure within weak to moderate very coarse prisms.

In Wyoming County two mapping units of Williamson channery silt loam are recognized. They differ from the defined range for the series in that they have a channery mantle of silt loam, loam, or fine sandy loam that is 14 to 34 inches thick over the silt and very fine sand deposit.

The content of coarse fragments ranges from 10 to 35 percent in the mantle and is less than 2 percent in the underlying silty material. The Bx horizon generally is in the underlying silty deposit, but where the channery mantle is thick enough, the Bx horizon occurs in both deposits. The channery fragments interfere slightly with tillage operations for some crops, in contrast to the representative Williamson soils.

Williamson soils are in a drainage sequence with the somewhat poorly drained Wallington soils that formed in similar material. They occupy positions on landscapes similar to those of the Arkport, Canaseraga, Caneadea, and Collamer soils. Williamson soils have a finer textured B horizon than Arkport soils and have a coarser textured B horizon than Caneadea soils. They have a fragipan that is lacking in Arkport, Caneadea, and Collamer soils. Williamson soils are similar to Canaseraga soils in the A horizon and upper part of the B horizon, but they lack the glacial till in lower part of the B horizon or C horizon that is characteristic of Canaseraga soils. Williamson soils are similar to the silty Allard and Scio soils, which lack the fragipan of Williamson soils. They do not have the stratified sand and gravel layers within 20 to 40 inches of the surface that are characteristic of Allard soils.

Williamson silt loam, 3 to 8 percent slopes (WoB).—This soil has the profile described as representative for the series. It is gently sloping and commonly is on convex landscapes that receive little or no runoff from adjacent soils. Individual areas vary in shape and generally are less than 25 acres in size.

Included with this soil in mapping were small areas of similar but somewhat poorly drained Wallington soils in slight depressions or on foot slopes. Also included were spots of Canaseraga soils in areas where this Williamson soil is adjacent to till landscapes on uplands. The Canaseraga soils are similar to Williamson soils in the surface layer and upper part of the subsoil, but the fragipan is in till. Minor inclusions were areas of well-drained Allard soils that are adjacent to gravelly outwash areas. The Allard soils are similar to this Williamson soil, but they lack the fragipan and are underlain by sand and gravel.

This stone-free silty soil is suited to row crops, pasture, or trees. If this soil is cultivated and not protected, the hazard of erosion is severe. Seasonal wetness delays planting for short periods in places. Lime is needed for most crops. Capability unit IIe-5; woodland suitability group 2o1.

Williamson silt loam, 8 to 15 percent slopes (WoC).—This moderately sloping soil is generally on undulating to rolling landscapes. Individual areas have no particular shape and generally are less than 20 acres in size.

Included with this soil in mapping were areas of similar but somewhat poorly drained Wallington soils in small depressions. Also included were areas of Canaseraga soils that are similar to Williamson soils, in the upper part, but the fragipan is in glacial till. Small spots of sandier, well-drained Arkport soils that are on similar landscapes were also included.

This soil is suited to row crops, but sod-forming crops should be favored in the cropping system because of the hazard of erosion. It is well suited to hay, pasture, and trees. Capability unit IIIe-6; woodland suitability group 2r2.

Williamson channery silt loam, 3 to 8 percent slopes (WsB).—The profile of this gently sloping soil differs from the one described as representative for the series in that the surface layer and upper part of the subsoil are channery silt loam or channery loam. Generally the lower part of the subsoil, which is a fragipan, formed in the underlying silt and very fine sand. In places, however, where the channery mantle is thick enough, the pan formed in deposits of silt and sand and in deposits of channery till. This soil is commonly on undulating landscapes. Individual areas range from 10 to 60 acres or more in size.

Included with this soil in mapping were small areas of a similar but wetter soil in depressions and areas of wetter Dalton soils that formed in thin mantles of silt over till. Also included, in areas where the till mantle is thicker over the silt, were small areas of Bath, Langford, and Mardin soils.

This soil is suited to crops, pasture, or trees. In places seasonal wetness delays planting for short periods, and in places the included wetter soils require drainage. If this soil is cultivated and not protected, the hazard of erosion is moderate. Complex slopes are common, so the use of contour measures to control erosion are not feasible in places. Capability unit IIw-3; woodland suitability group 2o1.

Williamson channery silt loam, 8 to 15 percent slopes (WsC).—The profile of this moderately sloping soil differs from the one described as representative for the series in that the surface layer and upper part of the subsoil are channery silt loam or channery loam. Also, in most areas this soil is better drained than the representative soil. This soil commonly is on undulating to rolling landscapes. Individual areas range from 5 to 35 acres or more in size. The thickness of the till mantle over silt varies erratically within short distances in this soil.

Included with this soil in mapping were spots of Williamson silt loam that lack the till mantle. Also included were small areas of Bath, Langford, and Mardin soils where the till mantle is more than 40 inches thick. Areas of similar but wetter soils in small depressions and along drainageways were also included.

This soil is suited to crops, pasture, or trees. If it is cultivated and not protected, the hazard of erosion is moderate to severe. Complex slopes are common, so the use of contour measures to control erosion is not feasible in places. In this situation sod-forming crops should be favored in the cropping system. Capability unit IIIe-2; woodland suitability group 2r2.

Formation, Morphology, and Classification of the Soils

Soils are natural three-dimensional bodies on the earth's surface. They are the products of soil-forming processes acting upon material deposited or accumulated by geologic forces. The five factors that affect the formation of soils are parent material, plant and animal life, climate, relief, and time.

Factors of Soil Formation

Climate and living organisms, particularly vegetation, are the active forces of soil formation. Their effect on

parent material is modified by relief and by the length of time the parent material has been in place. The relative importance of each factor differs from place to place. In a few places, one factor dominates and fixes most of the properties of the soil, but normally the interaction of all five factors determines the kind of soil that develops in any given place.

Parent material

Parent material is the unconsolidated mass in which the soils formed or are forming. It determines the mineralogical composition and contributes largely to the chemical composition of the soil. It also influences to a great extent the rate at which soil-forming processes take place as well as soil colors.

The mineral soils of Wyoming County formed in materials of mixed mineralogy, most of which are in different types of deposits as a result of glaciation. They came mainly from mixtures of soil material and acid to alkaline shale, siltstone, and sandstone, and in places some limestone. They occur in deposits of unsorted glacial till, water-sorted glacial outwash, and water-sorted glaciolacustrine sediment. Also, some soils formed or are forming in more recent alluvial deposits of these materials on flood plains, and others formed in accumulations of organic materials in some depressions.

Though much mixing of soil-forming materials has taken place as a result of glaciation, most of the till deposits commonly have as dominant components fragments and soil materials of the bedrock that underlies the till mass in that area. In Wyoming County the bedrock formations consist of interbedded shale, siltstone, and sandstone, so most of the soils on the till plain have formed in these materials. For example, Erie soils are closely associated with mildly alkaline siltstone bedrock formations, Bath soils with acid sandstone formations, and Hornell soils with acid clayey shale formations. In places the till mantle is very thin over acid sandstone and siltstone bedrock. Soils, such as the Arnot soils, have formed in these areas. The one exception to local rock formations being the only contributor to soil-forming materials in the till is in the northeast corner of the county. Here, limestone, which was plucked mainly from rock formations in Genesee County to the north, is mixed with the shale and sandstone materials. The till is calcareous in this area, and soils such as those of the Lansing and Conesus series have formed.

As the glacial ice melted, enormous quantities of water ran off and carried and sorted the glacially transported material. Along the faster moving bodies of water this material was redeposited in layers of sand and gravel as outwash plains, kames, eskers, and deltas. As is the case of soils formed in glacial till, the mineralogy of these water deposits is mixed. For example, Palmyra soils formed in outwash dominated by limestone, Howard soils in mixed limestone and sandstone deposits, and Chenango soils in those deposits dominated by sandstone. Minor amounts of outwash are shaly and were deposited mainly in the form of fans at the mouths of smaller streams that flowed through shaly areas.

Most of the larger valleys at one time contained glacial lakes where glacial melt waters were trapped between generally higher elevations to the south and the glacier on the north. The bulk of the sediment deposited in the quiet waters was clayey in texture and is the material in which such soils as those of the Caneadea series formed. Where there was some turbulence, the deposits were more silty, and such soils as those of the Collamer series formed. In places sandy deltas were deposited where streams flowed into the glacial lakes. Soils such as Arkport soils formed in these sandy deposits.

Though most of the soils in the county formed in just one type of glacial deposit—till, outwash, or lacustrine—the soils in places formed in contrasting layers of these depositional units. These include areas of silty lacustrine or eolian sediment over till in which the Canaseraga soils formed, and silty material over outwash sand and gravel in which the Allard soils formed. Also in this category are Varysburg soils that formed in stratified outwash over lacustrine clays (fig. 16), Churchville soils in glacial lake clays over till, Nunda soils where eolian silts or loamy till rests on clayey till, and Valois soils where glacial till is over glacial outwash.

Since the glacial period, overflowing streams have deposited fresh, dark, alluvial material in the valleys. This alluvium is the parent material for the Hamlin, Teel, and Wayland soils. Early in the post-glacial period, extensive outwash fans were built up by tributary streams at the toe slopes of the steep valley sides. The Herkimer soil is an example of a soil formed in these fans.

Geologically, the parent material in the county is relatively young. Essentially all of the surficial mineral deposits were laid down at about the end of the last ice age, or about 11,000 years ago. Alluvium is still deposited along the streams from time to time.

Saturated bogs are in some low spots scattered all across the county. Here, Palms muck soils formed in the partly decomposed remains of trees and other plants. Some of these organic pockets that are in the main valleys have a cover of alluvium. Wallkill soils are recognized in these situations.

Plant and animal life

All living organisms contribute to soil formation. These include vegetation, animals, bacteria, and fungi.

Wyoming County was originally in a native forest of hardwoods and conifers in varying proportions. Most hardwoods use large amounts of calcium and other bases if they are available. The loss of bases through leaching is inhibited by the hardwoods taking up the nutrients and then returning them to the soil surface each year as the leaves fall. Conifers do not use large amounts of nutrients; and, therefore, leaching is not retarded as it is under hardwoods.

Vegetation supports animal life in the soil. Earthworms and larger burrowing animals make the soil more permeable to air and water. Their waste products cause aggregations of soil particles and improve soil structure. The formation of organic acids by the action of bacteria and fungi on leaf litter is an aid in weathering soil minerals to available forms. Soil microbial life decomposes all the waste products returned to the soil, whether it is a sod cover crop or decomposable wastes of man.

Man's activity has brought about significant changes in many soils of the county. Clearing and tillage have accelerated erosion on most slopes. Artificial drainage has altered the environment of wet soils. In cultivated fields

Figure 16.—**Stratified glacial outwash resting on lacustrine clay.**

the organic-matter content of the surface layer has been altered, and in many places the A2 horizon has been destroyed. The microbiology of the soil is changed by continued use of lime, fertilizer, and pesticides.

Climate

Climate, particularly temperature and precipitation, is one of the most influential of the soil-forming factors. It determines to a large degree the kind of weathering process that occurs. It also affects the growth and kind of vegetation and the rate of leaching and translocation of weathered materials.

Wyoming County has a humid, temperate climate. Climatic data for the county are given in the section "General Nature of the County." The climate is nearly uniform throughout the county and does not vary enough to account for differences among soils. This humid, temperate climate tends to develop moderately weathered, leached soils.

Relief

The shape of the land surface, the slope, and the position in relation to the water table have had a great influence on the formation of soils in the county. High-lying soils that have convex slopes lose some of the rain that falls to soils in adjacent lower areas. This loss can cause a difference in the amount of water that is absorbed by the soils in different parts of the landscape. The soils in lower areas remain saturated for longer periods than do soils on adjacent, more sloping parts of the terrain. The sloping soils commonly are drier and have a brighter colored, unmottled subsoil, while in wet areas the subsoil is more grayish colored and is mottled, and the surface layer is much darker. This dark surface layer is caused by a buildup of organic matter, because the excess water slows the rate at which plant residue is decomposed by micro-organisms.

Soils that formed in one kind of parent material, but that have different characteristics because of different degrees of wetness, are said to be in a drainage sequence. For example, the Castile, Chenango, Halsey, and Red Hook soils are members of a drainage sequence. Chenango soils are on the well-drained and Halsey soils on the very poorly drained end of the sequence. In Wyoming County the different soils are largely the result of differences in parent material or differences in relief.

Time

Time is a passive soil-forming factor. The degree of profile development is a reflection of the age of a soil. A mature soil has well-drained horizons, while an immature soil has not had enough time for distinct horizons to form.

Geologically, the deposits of soil materials in the county are very young. Most of the material was left after the last glacier melted, about 11,000 years ago. All the soils, have not reached the same stage of profile development, however, because other soil-forming factors also influence the rate and kind of development in various soils.

Bath and Chenango soils are among the oldest in the county. Such soils as Howard and Lansing appear to be younger, but this is caused by a difference in parent material. All these soils have well-expressed genetic horizons. Soils on recent alluvium that is deposited each time the adjacent stream floods have poorly expressed genetic horizons.

Morphology of Soils

If a vertical cut is dug into a soil, several layers, or horizons, are evident. The differentiation of horizons is the result of many soil-forming processes. The most important of these are the following: (1) physical weathering, such as thawing and freezing; (2) leaching of salts that are more or less soluble; (3) accumulation of organic matter; (4) chemical weathering of primary minerals or rocks into silicate clay minerals; (5) translocation of silicate clay mineral from one horizon to another by percolating water; (6) accumulation of some iron colloids; and (7) formation of dense or compact layers in the subsoil.

Some of these processes take place in all the soils, but the number of active processes and the degree of their activity vary from one soil to another.

In all of the mineral soils, some organic matter has accumulated to form an A1 horizon. In wooded areas these mineral soils have an organic horizon at the surface. This is designated as an O1 or O2 horizon, depending on the extent to which the organic material has decomposed. If the soils are cleared and plowed, their organic and A1 horizons lose their identity as they are mixed into the plow layer, which is called an Ap horizon. This horizon is enriched in organic matter and generally is distinct from the underlying horizons because it is darker and more friable. The Ellery and Lyons soils are examples of soils that have a distinctive, dark-colored Ap horizon. Only in the recent alluvial soils is there no sharp contrast between the A1 or the Ap horizon and the next underlying horizon.

The upper horizons of a soil generally are more leached of bases and silicate clays than the lower horizons. The leached part of the A horizon that is too far below the surface to be influenced by surface organic matter is called the A2 horizon. Normally, it is the lightest colored horizon in the soil. It is well expressed in such soils as the Howard and Lansing.

In soils that have a B horizon of clay accumulation, the clay removed from the A horizon is immobilized in what is designated as the B2t horizon. Of all the horizons in the soil, this one contains the highest concentration of clay and is the brownest. Conesus, Danley, and Palmyra are among the soils that have a well-expressed B2t horizon.

The subsoil of some soils has a distinct zone of yellowish brown that differs little or none in texture from the A horizon. This zone is called a color B horizon. The Bath and Chenango soils have a strong color B horizon.

Characteristics that indicate relative wetness, or class of drainage, are evident in soils. Excess water commonly produces mottles, or a pattern of color, dominantly gray. The extent of mottling indicates the degree of gleying, or the process of chemical reduction and transfer of iron. A gleyed soil normally is gray or bluish gray. Locally, soil layers of this color are called blue clay, a name given to soil material excavated at many pond sites.

In soils that are well aerated, brown or yellowish brown is the normal color. A soil is considered well drained if it is free of mottles to a depth of at least 20 inches and shows only brown colors. Among the well-drained soils in this county are Lansing and Valois. Moderately well drained soils generally are wet for short periods and are free of mottles to a depth of 16 to 20 inches. Conesus and Langford soils are examples of moderately well drained soils. In somewhat poorly drained soils, water is removed slowly enough to keep the soil wet for significant periods but not all of the time. These soils generally have a prominent pattern of mottling in the subsoil and have both gray and brown colors that indicate alternately wet and dry conditions. Dalton and Fremont soils have this extensive pattern of prominent mottling.

In areas where the soils are wet for long periods of time and are poorly drained, the A2 horizon shows the effect of moderate or intense reduction of iron. This horizon is dominantly gray but includes a few brown mottles. Within some areas of poorly drained soils are small depressions that remain saturated most of the year unless they are artificially drained. Here, drainage is very poor, the surface layer has a high organic-matter content, and the soils are mucky. Papakating and Sun soils are examples of poorly drained or very poorly drained soils.

Many of the soils in Wyoming County have a distinct fragipan. This is a very firm and brittle layer that formed in the subsoil in many areas that are dominantly medium-textured, low-lime and acid glacial till. Erie, Mardin, and Volusia soils have a well-expressed fragipan.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics, assemble knowledge about them, see their relationships to one another and to the whole environment, and develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The soils of Wyoming County are classified according to a system adopted for general use by the National Cooperative Soil Survey in 1965 (*7*). This system is under continual study. Therefore, readers interested in developments of this current system should search the latest literature available. In table 9 the soil series of Wyoming County are classified in the current system. Placement of some soil series may change as more precise information becomes available.

TABLE 9.—*Soil series classified according to the current system*

Series	Family	Subgroup	Order
Alden	Fine-loamy, mixed, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Allard	Coarse-silty over sandy or sandy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Angola	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Appleton [1]	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Arkport	Coarse-loamy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Arnot	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Aurora	Fine-loamy, mixed, mesic	Glossaquic Hapludalfs	Alfisols.
Bath	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Burdett	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Canadice	Fine, illitic, mesic	Typic Ochraqualfs	Alfisols.
Canaseraga	Coarse-silty, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Caneadea	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Castile	Loamy-skeletal, mixed, mesic	Aquic Dystrochrepts	Inceptisols.
Chenango	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Churchville	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Collamer	Fine-silty, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Conesus	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Dalton	Coarse-silty, mixed, mesic	Aeric Fragioquepts	Inceptisols.
Danley	Fine-loamy, mixed, mesic	Glossaquic Hapludalfs	Alfisols.
Darien	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Ellery	Fine-loamy, mixed, mesic	Typic Fragiaquepts	Inceptisols.
Erie	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Fremont	Fine-loamy, mixed, acid, mesic	Aeric Haplaquepts	Inceptisols.
Halsey	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic.	Mollic Haplaquepts	Inceptisols.
Hamlin	Coarse-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Herkimer	Coarse-loamy, mixed, mesic	Dystric Eutrochrepts	Inceptisols.
Homer	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Aeric Ochraqualfs (Typic)	Alfisols.
Hornell	Fine, illitic, acid, mesic	Aeric Haplaquepts	Inceptisols.
Howard	Loamy-skeletal, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Ilion	Fine-loamy, mixed, mesic	Mollic Ochraqualfs	Alfisols.
Langford	Fine-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Lansing	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Lordstown	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Lyons	Fine-loamy, mixed, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Madrid	Coarse-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Manlius	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Mardin	Fine-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Marilla	Fine-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Niagara	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Nunda	Fine-loamy, mixed, mesic	Glossaquic Hapludalfs	Alfisols.
Palms	Loamy, mixed, euic, mesic	Terric Medisaprists	Histosols.
Palmyra	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Papakating	Fine-silty, mixed, nonacid, mesic	Mollic Fluvaquents	Entisols.
Phelps	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Glossaquic Hapludalfs	Alfisols.
Red Hook	Coarse-loamy, mixed, acid, mesic	Aeric Haplaquepts	Inceptisols.
Scio	Coarse-silty, mixed, mesic	Aquic Dystrochrepts	Inceptisols.
Sun	Coarse-loamy, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols.
Teel	Coarse-loamy, mixed, mesic	Fluventic Eutrochrepts	Inceptisols.
Tioga	Coarse-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Tuller	Loamy-skeletal, mixed, acid, mesic	Lithic Haplaquepts	Inceptisols.
Valois	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Varysburg	Loamy-skeletal over clayey, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Volusia	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Wallington	Coarse-silty, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Wallkill	Fine-loamy, mixed, nonacid, mesic	Thapto-Histic Fluvaquents	Entisols.
Wayland	Fine-silty, mixed, nonacid, mesic	Mollic Fluvaquents	Entisols.
Williamson	Coarse-silty, mixed, mesic	Typic Fragiochrepts	Inceptisols.

[1] A fairly large acreage of the Appleton soils in Wyoming County has a thicker solum than defined for the series.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, mode, or origin are grouped together. The classes that make up the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil order are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. The four soil orders represented in Wyoming County are Alfisols, Entisols, Histosols, and Inceptisols.

SUBORDER: Each order is divided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The suborder is not shown in table 9.

GREAT GROUP: Soil orders are separated into great groups on the basis of uniformity in the kind and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans interfering with growth of roots or movement of water. The features used are the self-mulching properties of clay; soil temperature; and major differences in chemical composition, mainly calcium, magnesium, sodium, and potassium. The great group is not shown separately because the name of the great group is the last word in the name of the subgroup.

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups can also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of great groups.

FAMILY: Families are established within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils if used for engineering. Among the properties considered in Wyoming County are texture, mineralogy, reaction, and soil temperature.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established, and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series at the state, regional, and national levels of responsibility for soil classification results in a judgment that the new series should be established. Most of the soil series described in this publication have been established earlier. None of the soil series used in this survey had tentative status when the survey was sent to the printer.

General Nature of the County

This section provides general information about Wyoming County. It discusses geology, physiography, drainage, water supply, climate, farming, and land use. Other items of general interest also covered are vegetation, settlement, population, industry, transportation, and markets.

Geology

Wyoming County is underlain by bedrock of the Devonian age. Formations of the Middle Devonian age are at lower elevations, while those of the Upper Devonian are are at higher elevations. The stratum of bedrock is almost horizontal but has a slight dip to the south of approximately 60 feet per mile.

Rock outcrops of the Canadaway, Genesee, Hamilton, Java, Naples, Sonyea, and West Falls groups are in the county. The formations at the lowest elevations are dominantly shale that is fine grained and high in carbonates. Increasing amounts of more acid and coarse-grained strata are higher in the stratigraphic column (fig. 17). These dominantly shaly formations make up rock strata that are more than 600 feet thick.

At the higher elevations in the northern part of the county and at midelevations in the central part, the formations increase in content of sandstone strata. The most prominent of these is the Nunda formation. It forms the cap rock of the "Upper Falls" in Letchworth State Park. North of the "Lower Falls" the Gardeau, Grimes, and Hatch formations make up the canyon walls of the Portage "High Banks" area. Formations of the Canadaway group underlie the smooth upper slopes of the plateau in the central and southwestern parts of Wyoming County. These beds are the highest in the stratigraphic column. They are made up of various interbedded sandstone, siltstone, and shale layers.

During the Wisconsin glacial stage of the Pleistocene epoch, Wyoming County was completely covered by ice. Although the Wisconsin stage of glaciation has been divided into four substages, only two are readily recognized in this county. In New York State, they are called the Valley Heads drift sheet and the Binghamton drift sheet. The latter is the older of the two. The two drift sheets are briefly described in the following paragraphs.

The Valley Heads drift sheet consists of glacial till and ground moraines, proglacial fluvial deposits, and proglacial lacustrine sediment.

The glacial till is dominantly grayish brown, but it ranges from brown to gray and has many olive hues. These colors reflect the influence of material that came from glacial scouring of middle and upper Devonian rock strata. The drift is variable in thickness. It is thick in drumlin-type landforms in the northeastern part of the county and is thin on many exposed slopes on the plateau. The car-

Figure 17.—Gorge of interbedded acid sandstone and shale bedrock over alkaline shale.

bonate content is also variable, and the thick till at lower elevations contains the most carbonate.

The proglacial fluvial deposits consist chiefly of stratified sand and gravel laid down by glacial melt water. These are the valley train terraces near Pearl Creek and Attica and the kame terraces that erratically line all the valley sides of the north-flowing streams. At the headwaters of the north-flowing streams are extensive deposits of water-sorted silt and clay. These settled out in glacial lakes that were trapped between the ice to the north and the surrounding higher areas.

The glacial ice of the Binghamton drift also overrode the same landscape covered by the Valley Heads drift, but at an earlier period. The effects of the Binghamton sheet are more noticeable in the acid, deeply leached till and stratified deposits at the higher elevations in the central part of the county and across the southern half. Some of the terraces appear to have been deposited during a retreat of the terminal moraine and then reglaciated during the Binghamton advance because stratification is disturbed to a great depth in some of these kame deposits. Few or no lake sediments are readily identifiable to this drift sheet; however, extensive areas were mantled with wildblown silt, some of which subsequently received a covering of ablation till from this or the following upper reaches of the Valley Heads advance.

The postglacial deposits in the county consist of recent alluvium along existing streams as well as muck and peat in swamps. Occasionally some rock and soil debris is deposited on the fans of tributary streams. Oatka Creek, between the villages of Warsaw and Wyoming, has the largest deposition zone of recent alluvium. Parts of the other remaining larger streams also have flood zones but are much narrower because of the higher stream gradient. The

Genesee River has a flood zone south of Portageville, but farther north it is confined to the Letchworth gorge.

Physiography and Drainage

Wyoming County is in the Appalachian Uplands physiographic province of New York State. The Ontario lowlands approach the extreme northeastern corner of the county.

The Appalachian Uplands is a plateau that is moderately dissected by streams. The depth of stream cutting and the difference in elevation between the valley floors and the surrounding uplands ranges from 300 to 700 feet. The most striking physiographic features, the Portageville Canyon and the high banks of the Genesee River, are the result of postglacial stream cutting.

The streams in the southern part of the county, except for the Genesee River, do not occupy deep, narrow valleys as do the streams in the northern part. These streams flow at a level more nearly equal to that of the plateau summit.

The valley occupied by Oatka Creek is the largest in the county. It extends from just south of Warsaw to beyond the Genesee County line. Its side slopes rise abruptly above the flood plain for a distance of about one-half mile and then continue rising at a decreasing rate to areas of maximum elevation.

The area between the valleys consists of rolling uplands and many flat-topped hills. This is partly caused by the nearly horizontal position of the underlying bedrock, which dips very gently to the south. The relief is partly the result of the action of the ice that entirely covered the county during the last continental glaciation and then to postglacial stream cutting. The drumloidal configuration of many upland landforms across the northeastern part of the county is the result of molding by glacial ice. The steep ravines that cut back from the main valleys are the result of postglacial stream cutting.

Large areas of rolling, hummocky topography are in the southern half of the county. These are deposits of stratified drift that have accumulated along relatively stationary ice fronts. Occasionally the ice front readvanced to plane down these stratified, hummocky landforms.

The lowest elevation of 627 feet is at a point where the Genesee River leaves the county on the east. The highest elevation is just over 2,100 feet and is near the Allegany County line in the southern part. The highest elevation is in the south-central part, while elevations of 1,000 feet are common in the valley floors in the northern part.

Wyoming County is in the Erie-Ontario drainage basin. The eastern part drains into Lake Ontario through Oatka, Wiscoy, and East Koy Creeks and the Genesee River. The western part drains into Lake Erie through Cattaraugus, Buffalo, Cayuga, and Tonawanda Creeks.

Water Supply

In areas of the county where water is not supplied by a municipal facility, it is obtained from drilled wells. Water for a few homes in rural sections is provided by shallow wells or developed springs. Ponds or streams also furnish water for livestock.

Silver Lake is used for a water supply by the village of Perry and by several communities in neighboring counties. Large reservoirs supply the village of Attica in Wyoming County, Le Roy in Genesee County, and Akron in Erie County. Most other municipal facilities are supplied by drilled wells or developed springs.

Climate [8]

Wyoming County has a humid-continental climate. Continental areas of North America are the main source of air masses and weather systems that affect the county. The Atlantic Ocean is of secondary importance in its effect on the climate. Atmospheric moisture from the Atlantic Ocean and the Gulf of Mexico flows into the region and causes the county to be humid.

The summer is moderately warm, and the average temperature during the warmest month is less than 70° F. The winters are cold and have much cloudiness and extended periods of stormy, unsettled weather. Precipitation is at a minimum in winter and increases and becomes uniform in amount from March through November. Table 10 gives temperatures and precipitation data compiled from records at Warsaw.

Most weather systems moving toward the northeastern United States affect Wyoming County. This results in a variety of weather. Temperature, humidity, wind, and cloudiness generally undergo noticeable changes within a few days. The weather during one week commonly differs appreciably from that of the previous or succeeding week. Atmospheric conditions, however, occasionally persist for many days without any important change. Seasonal weather normally varies from year to year.

The climate in much of the county is conditioned by the relatively high elevation. Topography and elevation counteract the moderating effects on temperature that otherwise would be expected from the nearness of the Great Lakes. Precipitation in winter, however, is greatly influenced by these large bodies of water, especially by Lake Erie. In places changes in elevation, aspect of slope, or terrain features result in important variations of temperature and other elements of climate within relatively short distances.

Average temperatures tend to be lowest in the southwestern part of the county and to increase in a northeasterly direction. During the warmer months the temperature remains below 90° F. in about half of the years. Temperatures below 0° F. can be expected on 10 to 20 days between early December and early March. The coldest temperature in most winters ranges between −10° F. and −20° F.

The freeze-free season averages 120 days or less in the southern half of the county but increases to about 140 days in northeastern parts. In places, however, topographic features result in important local differences in the length of this season. Table 11 gives the probability of the last freezing temperature in spring and the first in fall.

Annual precipitation is between 38 and 41 inches in the western, southwestern, and central parts of Wyoming County. Amounts decrease to 34 to 36 inches along the eastern and northern edges of the county. Rainfall during the growing season from May through September totals from 15 to 18 inches, and the heaviest amounts occur

[8] By A. BOYD PACK, State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature and precipitation data*

[Data from Warsaw]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	7 years in 10 will have—		Average monthly total	3 years in 10 will have—		Snowfall	
			Maximum temperature equal to or higher than—	Minumum temperature equal to or lower than—		More than—	Less than—	Average monthly total	7 years in 10 will have more than—
	° F	° F	° F	° F	Inches	Inches	Inches	Inches	Inches
January	28	12	46	−10	2. 9	3. 6	2. 0	19	14
February	30	12	47	−10	2. 5	2. 7	1. 9	16	13
March	38	20	58	3	3. 3	4. 4	2. 4	19	14
April	54	33	74	18	3. 7	4. 6	2. 8	6	2
May	65	42	80	28	3. 1	4. 0	2. 3	1	[1] 2
June	75	51	86	36	3. 2	4. 6	2. 0	0	0
July	78	55	86	42	3. 1	4. 1	2. 2	0	0
August	76	54	85	40	4. 3	5. 0	2. 7	0	0
September	70	47	82	32	3. 0	4. 3	1. 5	0	0
October	59	39	77	24	3. 1	4. 0	1. 4	1	[1] 2
November	45	29	65	11	3. 7	4. 9	2. 8	13	9
December	32	17	53	−9	2. 8	3. 3	2. 5	17	14
Year	54	34	88	−14	38. 7	40. 4	35. 8	92	86

[1] One year in ten.

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall at Warsaw*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	April 15	April 26	May 10	May 22	June 5.
2 years in 10 later than	April 10	April 22	May 2	May 15	May 30.
5 years in 10 later than	April 1	April 13	April 23	May 6	May 24.
Fall:					
1 year in 10 earlier than	November 7	October 24	October 7	September 21	September 8.
2 years in 10 earlier than	November 12	October 30	October 15	September 27	September 12.
5 years in 10 earlier than	November 22	November 7	October 28	October 9	September 20.

in the southwestern part. Short periods of temporary moisture stress for crops can be expected during most growing seasons. Severe drought is not a serious hazard to farming, but its occurrence should not be disregarded in long-range planning.

Snowfall is heavy. Seasonal totals average between 85 and 100 inches in the county, except in the extreme northeastern part where the amount decreases to about 70 inches. The "lake-effect" precipitation process contributes heavy snow, especially to the western half of the county, when the airflow is by way of Lake Erie. A snow cover generally is maintained from early in December to the middle of March.

Farming and Land Use

The 1964 census shows that of the 382,720 acres in the county, 269,776 acres were in farms. Dairying is the main type of farming enterprise.

The number of farms in the county has decreased steadily from 3,165 in 1920, to 2,063 in 1954, and to 1,306 in 1964. Correspondingly, the size of remaining farms has increased from 110 to 155 and finally to 206 acres each during that same time period.

Before 1930 a wide variety of grain and vegetable crops was grown. In recent years only the production of grain and forage used in dairying and dry beans, potatoes, and

maple products have been a significant part of farming in the county. Among counties in New York State, the 1964 census ranks Wyoming as third in potato crops, sixth in maple products, seventh in dry-bean crops, and tenth in value of dairy products.

In 1964 crop production by acres was 38,440 for alfalfa, 19,057 for silage and grain corn, 18,254 for oats, 6,146 for wheat, 6,083 for dry beans, and 4,067 for potatoes.

The number of dairy animals has remained fairly constant for the past 25 years. In 1964 there were 33,355 cattle. Beef cattle, poultry, sheep, and swine are also produced in the county, but they are much less important to the economy than dairy cattle.

Some farms produce a considerable amount of canning crops, such as sweet corn, peas, and snap beans.

Vegetation

Before the first settlers arrived, nearly all of Wyoming County was wooded. The original forests consist of white pine, hard maple, beech, basswood, ash, hickory, and oak. Wetter soils had stands with more red maple and American elm, while hemlock was dominant in some of the deeper gullies. Small areas of virgin forest still remain.

The second-growth forests consist principally of maple and beech, but considerable numbers of wild black cherry, basswood, and ash are also present. Hemlock is dominant in some of the wetter areas. Most of the oaks are on the slopes above the Genesee River. Originally the chestnut trees and recently the American elm have been virtually eliminated by disease.

The original forests were open and comparatively free of underbrush, but the present forests have an underbrush of witch hazel and alder.

Where idle fields are allowed to revert to trees, the better drained soils generally are covered by hawthorn, aspen, white ash, maple, or beech. White pine also regenerates if it grows in nearly wooded tracts. Wet soils revert mostly to soft maple. Large areas that were formerly used for crops have been planted to coniferous trees, mainly Scotch pine, Norway spruce, and white spruce.

Many areas of sugar maple are scattered across the county. Most of these are managed for syrup and other maple products.

Settlement

The first settlement in Wyoming County took place about 1800 in what is now the village of Wyoming. The village of Warsaw was founded a few years later. From this time up until about 1850, settlement by people from eastern New York and the New England States was rapid.

Most of the lands west of the Genesee River were part of the Holland Land Grant and were included in the survey of Genesee County. Wyoming County was formed from this original grant in 1841.

Population

Until 1850, the population of the county rose sharply, and settlers came from points farther east. Since that time the population has shown a very slow upward trend. The number of inhabitants began to decrease about the time of World War I and continued to decrease until about 1935. Census figures list the population as 23,726 in 1845, 30,413 in 1900, 30,314 in 1920, 31,394 in 1940, and 34,793 in 1960.

In 1902 there were 21,975 rural residents in the county, and 9,102 of them lived elsewhere than on a farm. In 1960 there were 23,753 rural residents, and 17,053 of them did not live on farms. The population within corporate villages rose from 8,339 to 11,040 between the years of 1920 and 1960. Perry, the largest village, has a population of about 4,500. Warsaw, the county seat, has a population of about 3,500, and Arcade has a population of about 1,800. Several other smaller communities are part of the rural nonfarm population.

Industry, Transportation, and Markets

Many industries are in the county. The principal items of manufacture are cutlery, time clocks, knit goods, electronic parts, and various other metal, wood, and plastic products. A salt mine is in the village of Silver Springs. Some food processing plants are in adjacent counties.

The county is crossed by two railroads, the Erie-Lackawanna and the Baltimore and Ohio. The Arcade and Attica is a small branch line that serves the industries in the Arcade area and conducts steam-locomotive excursion tours.

Among the many roads in the county are U.S. Highway 20A and 12 State highways. Commercial airline service is available at Buffalo and Rochester, both of which require a trip of only an hour or less from Warsaw.

Except for the food processing plants in adjacent counties, the market for fresh vegetables and dairy products is mainly in the Buffalo and Rochester areas. Late in fall and in winter, potatoes processed primarily to make potato chips are marketed throughout the eastern part of the United States. Most of the dry bean crop is marketed locally. About two- thirds is used in domestic consumption and one-third is exported, mainly to Latin American countries.

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Glossary

Ablation till or moraine. Relatively loose permeable till material deposited during the final downwasting of the glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Basal till. Compact glacial till deposited largely by lodgment beneath the ice.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Congeliturbate. Soil material disturbed by frost action.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Esker (geology). A narrow, winding ridge or mound of stratified gravelly and sandy drift that was deposited by a subglacial stream.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Glacial drift (geology). Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted materials deposited by streams flowing from glaciers.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.

Graded stripcropping. Growing of crops in strips that are graded toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Heavy-textured soils. Sandy clay, silty clay and clay.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Kame. Short ridge, hill, or hillock of stratified glacial drift.

Lacustrine, glacio. Deposits that range from fine clays to sand. They were derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Light-textured soils. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Medium-textured soil. Soil of very fine sandy loam, loam, silt loam, or silt texture.

Moderately heavy-textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moderately light-textured soils. Sandy loam and fine sandy loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are these: terminal, lateral, medial, ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Outwash, glacial. Stratified sands and gravels produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Commonly the deposits occupy valley positions on landforms known as valley trains or outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Runoff. The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sandstone. A sedimentary rock containing dominantly sand size particles.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Siltstone. A sedimentary rock containing dominantly silt size particles.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, glacial outwash, or glacio-lacustrine deposits.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, to serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terace. Land above the lowlands along rivers.

Varves. Distinctly marked annual deposits of sediment, regardless of their origin.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

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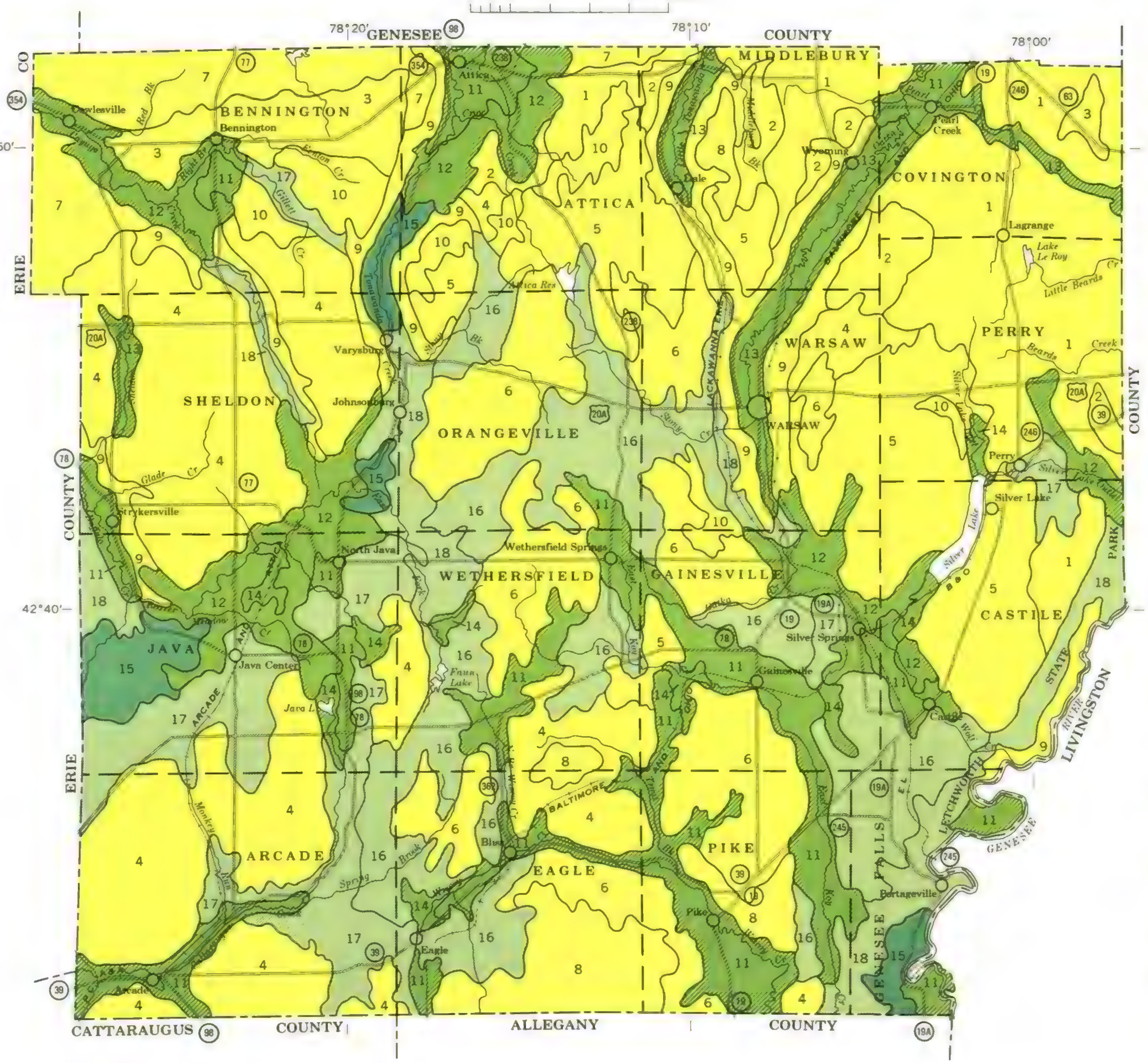
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

WYOMING COUNTY, NEW YORK

Scale 1:190,080

1 0 1 2 3 4 Miles



SOIL ASSOCIATIONS

SOILS FORMED IN GLACIAL TILL

1 Conesus-Lansing association: Deep, moderately well drained and well drained, medium-lime soils that have a medium-textured subsoil; on uplands

2 Nunda-Danley association: Deep, moderately well drained, medium-lime soils that have a moderately fine textured subsoil; on uplands

3 Darien-Ilion association: Deep, somewhat poorly drained and poorly drained, medium-lime soils that have a moderately fine textured subsoil; on uplands

4 Erie-Langford association: Deep, somewhat poorly drained, moderately well drained and well drained, low-lime soils that have a medium-textured subsoil; on uplands

5 Bath-Mardin association: Deep, well drained and moderately well drained, very low lime soils that have a medium-textured subsoil; on uplands

6 Volusia-Mardin association: Deep, somewhat poorly drained and moderately well drained, very low lime soils that have a medium-textured subsoil; on uplands

7 Fremont-Marilla-Hornell association: Deep and moderately deep, somewhat poorly drained and moderately well drained, very low lime soils that have a medium-textured to fine-textured shaly subsoil; on uplands

8 Fremont-Mardin association: Deep, somewhat poorly drained and moderately well drained, very low lime soils that have a moderately fine textured and medium-textured subsoil; on uplands

9 Manlius-Lordstown association: Moderately deep, well-drained to excessively drained, very low lime soils that have a medium-textured subsoil; on uplands

10 Lordstown-Tuller-Arnot association: Moderately deep and shallow, well-drained to poorly drained, very low lime soils that have a medium-textured subsoil; on uplands

SOILS FORMED IN GLACIAL OUTWASH OR KAME DEPOSITS AND OLD ALLUVIAL FAN DEPOSITS

11 Chenango-Howard-Castile association: Deep, somewhat excessively drained to moderately well drained, very low lime to medium-lime soils that have a medium-textured and moderately coarse textured very gravelly and gravelly subsoil; on outwash terraces and fans

12 Howard-Chenango association: Deep, well-drained and somewhat excessively drained, medium-lime and very low lime soils that have a medium-textured and moderately coarse textured very gravelly subsoil; on outwash kames

13 Herkimer-Wayland-Wallkill association: Deep, well-drained to very poorly drained, medium-lime to high-lime soils that have a medium-textured and moderately fine textured subsoil; on outwash fans and flood plains

14 Halsey-Palms-Papakating association: Deep, very poorly drained and poorly drained, medium-lime soils that have a moderately coarse textured to moderately fine textured mineral subsoil or an organic layer; on outwash terraces and flood plains

SOILS FORMED IN GLACIAL LAKE SEDIMENT

15 Canadea association: Deep, somewhat poorly drained and moderately well drained, medium-lime to high-lime soils that have a moderately fine textured to fine textured subsoil; on glacial lake deposits

SOILS FORMED IN CONTRASTING GLACIAL DEPOSITS

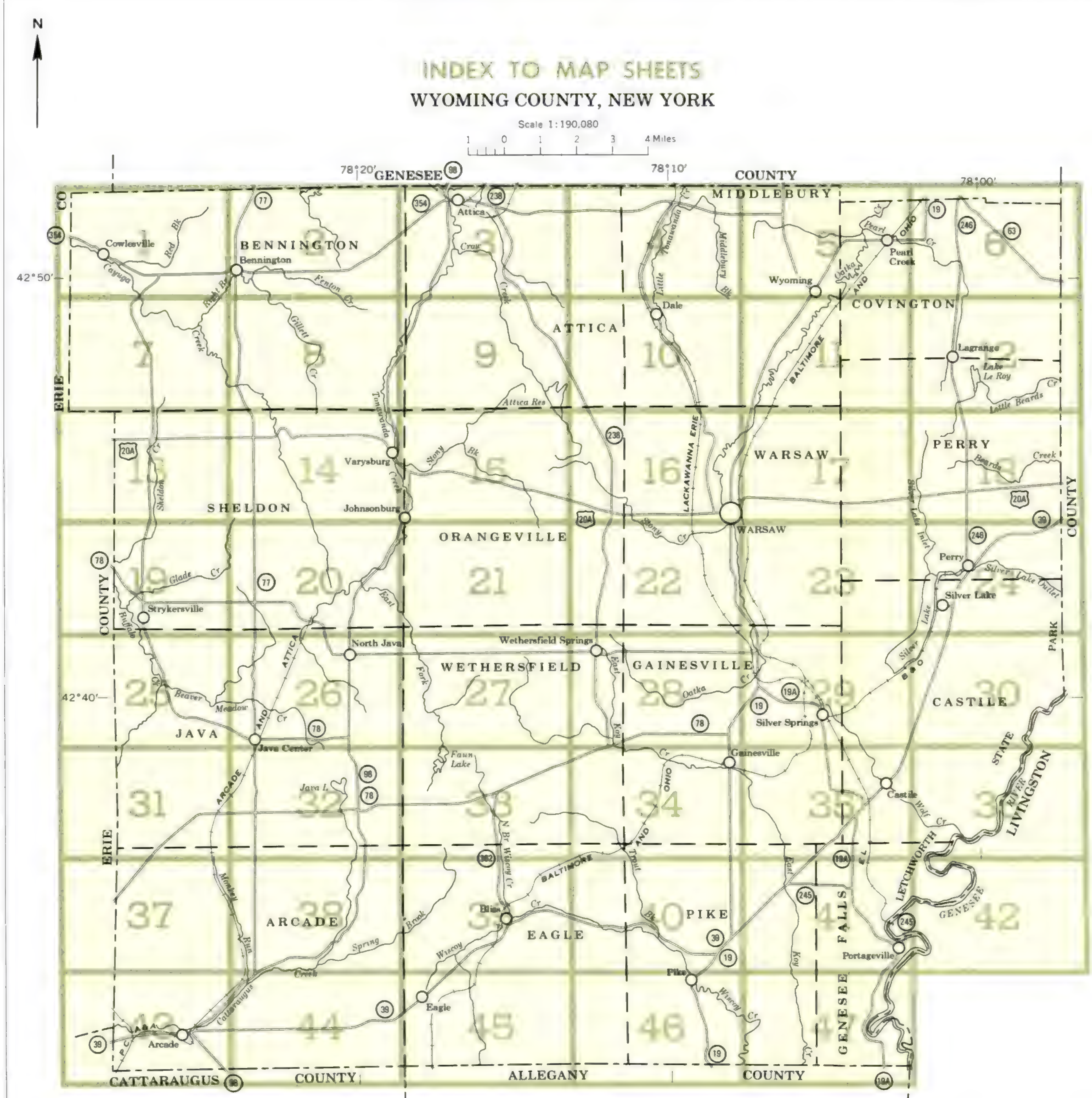
16 Bath-Valois association: Deep, well-drainea, very low lime soils that have a medium-textured and moderately coarse textured subsoil; on morainic uplands

17 Howard-Madrid association: Deep, well-drained and somewhat excessively drained, medium-lime soils that have a medium-textured and moderately coarse textured subsoil that is very gravelly in places; on kamy outwash and adjacent morainic uplands

18 Varysburg-Williamson-Churchville association: Deep, well-drained to somewhat poorly drained, very low lime to high lime soils that have a medium-textured to fine-textured subsoil; on valley-side deposits

Compiled 1972

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Cornell University Agricultural Experiment Station.

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, is a general guide to the slope class. Symbols without a slope letter are for those soils or miscellaneous land types where slope is not significant to use and management. A final number, 3, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Ad	Alden mucky silt loam
AlA	Allard silt loam, 0 to 3 percent slopes
AlB	Allard silt loam, 3 to 8 percent slopes
AlC	Allard silt loam, 8 to 15 percent slopes
Am	Alluvial land
AnA	Angola shaly silt loam, 0 to 3 percent slopes
AoB	Angola and Aurora shaly silt loams, 3 to 8 percent slopes
ApA	Appleton gravelly silt loam, 0 to 3 percent slopes
ApB	Appleton gravelly silt loam, 3 to 8 percent slopes
ArB	Arkport very fine sandy loam, 2 to 8 percent slopes
ArC	Arkport very fine sandy loam, 8 to 15 percent slopes
ArD	Arkport very fine sandy loam, 15 to 25 percent slopes
ArE	Arkport very fine sandy loam, 25 to 40 percent slopes
AtB	Arnot channery silt loam, 2 to 8 percent slopes
AtC	Arnot channery silt loam, 8 to 15 percent slopes
AuC	Aurora shaly silt loam, 8 to 15 percent slopes
BaA	Bath channery silt loam, 0 to 3 percent slopes
BaB	Bath channery silt loam, 3 to 8 percent slopes
BaC	Bath channery silt loam, 8 to 15 percent slopes
BaD	Bath channery silt loam, 15 to 25 percent slopes
BaE	Bath channery silt loam, 25 to 40 percent slopes
BlA	Bath-Valois gravelly loams, 0 to 3 percent slopes
BlB	Bath-Valois gravelly loams, 3 to 8 percent slopes
BlC	Bath-Valois gravelly loams, 8 to 15 percent slopes
BlD	Bath-Valois gravelly loams, 15 to 25 percent slopes
BuA	Burdett silt loam, 0 to 3 percent slopes
BuB	Burdett silt loam, 3 to 8 percent slopes
Ca	Canadice silty clay loam
CcA	Canaseraga silt loam, 0 to 3 percent slopes
CcB	Canaseraga silt loam, 3 to 8 percent slopes
CcC	Canaseraga silt loam, 8 to 15 percent slopes
CdA	Caneadea silt loam, 0 to 3 percent slopes
CdB	Caneadea silt loam, 3 to 8 percent slopes
CdC	Caneadea silt loam, 8 to 15 percent slopes
CeD3	Caneadea silty clay loam, 15 to 25 percent slopes, eroded
CeE3	Caneadea silty clay loam, 25 to 50 percent slopes, eroded
CgA	Castile gravelly loam, 0 to 3 percent slopes
CgB	Castile gravelly loam, 3 to 8 percent slopes
ChA	Castile channery silt loam, fans, 0 to 3 percent slopes
ClA	Chenango gravelly loam, 0 to 3 percent slopes
ClB	Chenango gravelly loam, 3 to 8 percent slopes
ClC	Chenango gravelly loam, 8 to 15 percent slopes
ClD	Chenango gravelly loam, 15 to 25 percent slopes
CmB	Chenango channery silt loam, fans, 3 to 8 percent slopes
CnB	Churchville silt loam, 2 to 8 percent slopes
CnC	Churchville silt loam, 8 to 15 percent slopes
CoB	Collamer silt loam, 3 to 8 percent slopes
CoC	Collamer silt loam, 8 to 15 percent slopes
CoD	Collamer silt loam, 15 to 25 percent slopes
CrA	Conesus gravelly silt loam, 0 to 3 percent slopes
CrB	Conesus gravelly silt loam, 3 to 8 percent slopes
CrC	Conesus gravelly silt loam, 8 to 15 percent slopes
DaA	Dalton silt loam, 0 to 3 percent slopes
DaB	Dalton silt loam, 3 to 8 percent slopes

SYMBOL	NAME
DeB	Danley silt loam, 3 to 8 percent slopes
DeC	Danley silt loam, 8 to 15 percent slopes
DlD3	Danley silty clay loam, 15 to 25 percent slopes, eroded
DlE3	Danley silty clay loam, 25 to 40 percent slopes, eroded
DnA	Darien silt loam, 0 to 3 percent slopes
DnB	Darien silt loam, 3 to 8 percent slopes
DnC	Darien silt loam, 8 to 15 percent slopes
Ee	Ellery silt loam
ErA	Erie silt loam, 0 to 3 percent slopes
EsB	Erie channery silt loam, 3 to 8 percent slopes
EsC	Erie channery silt loam, 8 to 15 percent slopes
FrA	Fremont silt loam, 0 to 3 percent slopes
FrB	Fremont silt loam, 3 to 8 percent slopes
FsC	Fremont channery silt loam, 8 to 15 percent slopes
FtD	Fremont and Hornell soils, 15 to 25 percent slopes
FtE	Fremont and Hornell soils, 25 to 40 percent slopes
Ha	Halsey loam
Hc	Hamlin silt loam
HeA	Herkimer shaly silt loam, 0 to 3 percent slopes
HeB	Herkimer shaly silt loam, 3 to 8 percent slopes
Hg	Homer gravelly loam
Hh	Homer gravelly loam, clayey substratum
HlA	Hornell silt loam, 0 to 3 percent slopes
HlB	Hornell silt loam, 3 to 8 percent slopes
HlC	Hornell silt loam, 8 to 15 percent slopes
HmA	Howard gravelly loam, 0 to 3 percent slopes
HmB	Howard gravelly loam, 3 to 8 percent slopes
HmC	Howard gravelly loam, 8 to 15 percent slopes
HmD	Howard gravelly loam, 15 to 25 percent slopes
HnA	Howard shaly silt loam, 0 to 3 percent slopes
HnB	Howard shaly silt loam, 3 to 8 percent slopes
HnC	Howard shaly silt loam, 8 to 15 percent slopes
HoB	Howard-Madrid gravelly loams, 3 to 8 percent slopes
HoC	Howard-Madrid gravelly loams, 8 to 15 percent slopes
HoD	Howard-Madrid gravelly loams, 15 to 25 percent slopes
HrB	Howard-Madrid shaly silt loams, 3 to 8 percent slopes
HrC	Howard-Madrid shaly silt loams, 8 to 15 percent slopes
HrD	Howard-Madrid shaly silt loams, 15 to 25 percent slopes
HsE	Howard and Chenango soils, 25 to 40 percent slopes
In	Ilion silt loam
LaA	Langford channery silt loam, 0 to 3 percent slopes
LaB	Langford channery silt loam, 3 to 8 percent slopes
LaC	Langford channery silt loam, 8 to 15 percent slopes
LaD	Langford channery silt loam, 15 to 25 percent slopes
LgB	Lansing gravelly silt loam, 2 to 8 percent slopes
LgC	Lansing gravelly silt loam, 8 to 15 percent slopes
LgD	Lansing gravelly silt loam, 15 to 25 percent slopes
LgE	Lansing gravelly silt loam, 25 to 40 percent slopes
LoB	Lordstown channery silt loam, 2 to 8 percent slopes
LoC	Lordstown channery silt loam, 8 to 15 percent slopes
LoD	Lordstown channery silt loam, 15 to 25 percent slopes
LoE	Lordstown channery silt loam, 25 to 40 percent slopes
Ly	Lyons silt loam

SYMBOL	NAME
MaB	Madrid fine sandy loam, 2 to 8 percent slopes
MaC	Madrid fine sandy loam, 8 to 15 percent slopes
MdB	Madrid loam, 2 to 8 percent slopes
MdC	Madrid loam, 8 to 15 percent slopes
MlB	Manlius shaly silt loam, 2 to 8 percent slopes
MlC	Manlius shaly silt loam, 8 to 15 percent slopes
MlD	Manlius shaly silt loam, 15 to 25 percent slopes
MlE	Manlius shaly silt loam, 25 to 40 percent slopes
MnF	Manlius and Lordstown soils, 40 to 90 percent slopes
MrA	Mardin channery silt loam, 0 to 3 percent slopes
MrB	Mardin channery silt loam, 3 to 8 percent slopes
MrC	Mardin channery silt loam, 8 to 15 percent slopes
MrD	Mardin channery silt loam, 15 to 25 percent slopes
MsB	Marilla shaly silt loam, 2 to 8 percent slopes
MsC	Marilla shaly silt loam, 8 to 15 percent slopes
Ng	Niagara silt loam
NuB	Nunda silt loam, 2 to 8 percent slopes
NuC	Nunda silt loam, 8 to 15 percent slopes
NuD	Nunda silt loam, 15 to 25 percent slopes
Pa	Palms muck
PgA	Palmyra gravelly loam, 0 to 3 percent slopes
PgB	Palmyra gravelly loam, 3 to 8 percent slopes
Pk	Papakating silt loam
Pm	Papakating mucky silt loam
PpA	Phelps gravelly loam, 0 to 3 percent slopes
PpB	Phelps gravelly loam, 3 to 8 percent slopes
Rh	Red Hook gravelly loam
Ro	Rock outcrop
ScA	Scio silt loam, 0 to 3 percent slopes
ScB	Scio silt loam, 3 to 8 percent slopes
Su	Sun silt loam
Te	Teel silt loam
Tg	Tioga silt loam
TuA	Tuller channery silt loam, 0 to 3 percent slopes
TuB	Tuller channery silt loam, 3 to 8 percent slopes
VaB	Varysburg gravelly loam, 2 to 8 percent slopes
VaC	Varysburg gravelly loam, 8 to 15 percent slopes
VaD	Varysburg gravelly loam, 15 to 25 percent slopes
VoA	Volusia channery silt loam, 0 to 3 percent slopes
VoB	Volusia channery silt loam, 3 to 8 percent slopes
VoC	Volusia channery silt loam, 8 to 15 percent slopes
Wa	Wallington silt loam
Wk	Wallkill silt loam
Wn	Wayland silt loam
WoB	Williamson silt loam, 3 to 8 percent slopes
WoC	Williamson silt loam, 8 to 15 percent slopes
WsB	Williamson channery silt loam, 3 to 8 percent slopes
WsC	Williamson channery silt loam, 8 to 15 percent slopes

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Number
HsE	Howard and Chenango soils, 25 to 40 percent slopes	161	VIe-1	27	2r3
In	Ilion silt loam	162	IVw-2	26	4w2
LaA	Langford channery silt loam, 0 to 3 percent slopes	163	IIw-2	18	3o1
LaB	Langford channery silt loam, 3 to 8 percent slopes	163	IIw-3	19	3o1
LaC	Langford channery silt loam, 8 to 15 percent slopes	163	IIIe-5	21	3o1
LaD	Langford channery silt loam, 15 to 25 percent slopes	164	IVe-4	25	3r1
LgB	Lansing gravelly silt loam, 2 to 8 percent slopes	164	IIe-1	17	2o2
LgC	Lansing gravelly silt loam, 8 to 15 percent slopes	164	IIIe-1	20	2o2
LgD	Lansing gravelly silt loam, 15 to 25 percent slopes	165	IVe-1	24	2r3
LgE	Lansing gravelly silt loam, 25 to 40 percent slopes	165	VIe-1	27	2r3
LoB	Lordstown channery silt loam, 2 to 8 percent slopes	165	IIe-2	17	3o1
LoC	Lordstown channery silt loam, 8 to 15 percent slopes	166	IIIe-2	20	3o1
LoD	Lordstown channery silt loam, 15 to 25 percent slopes	166	IVe-2	25	3r1
LoE	Lordstown channery silt loam, 25 to 40 percent slopes	166	VIe-2	27	3r1
Ly	Lyons silt loam	167	IVw-2	26	4w2
MaB	Madrid fine sandy loam, 2 to 8 percent slopes	168	IIe-1	17	2o2
MaC	Madrid fine sandy loam, 8 to 15 percent slopes	168	IIIe-1	20	2o2
MdB	Madrid loam, 2 to 8 percent slopes	168	IIe-1	17	2o2
MdC	Madrid loam, 8 to 15 percent slopes	168	IIIe-1	20	2o2
MlB	Manlius shaly silt loam, 2 to 8 percent slopes	169	IIe-2	17	3o1
MlC	Manlius shaly silt loam, 8 to 15 percent slopes	169	IIIe-2	20	3o1
MlD	Manlius shaly silt loam, 15 to 25 percent slopes	169	IVe-2	25	3r1
MlE	Manlius shaly silt loam, 25 to 40 percent slopes	169	VIe-2	27	3r1
MnF	Manlius and Lordstown soils, 40 to 90 percent slopes	169	VIIe-2	28	4r1
MrA	Mardin channery silt loam, 0 to 3 percent slopes	170	IIw-2	18	3o1
MrB	Mardin channery silt loam, 3 to 8 percent slopes	170	IIw-3	19	3o1
MrC	Mardin channery silt loam, 8 to 15 percent slopes	171	IIIe-5	21	3o1
MrD	Mardin channery silt loam, 15 to 25 percent slopes	171	IVe-4	25	3r1
MsB	Marilla shaly silt loam, 2 to 8 percent slopes	171	IIw-3	19	3o1
MsC	Marilla shaly silt loam, 8 to 15 percent slopes	172	IIIe-5	21	3o1
Ng	Niagara silt loam	172	IIIw-1	22	3w1
NuB	Nunda silt loam, 2 to 8 percent slopes	173	IIe-5	18	2o1
NuC	Nunda silt loam, 8 to 15 percent slopes	173	IIIe-6	21	2r2
NuD	Nunda silt loam, 15 to 25 percent slopes	174	IVe-5	25	2r1
Pa	Palms muck	174	-----	--	4w1
PgA	Palmyra gravelly loam, 0 to 3 percent slopes	175	IIs-1	19	2o2
PgB	Palmyra gravelly loam, 3 to 8 percent slopes	175	IIs-2	20	2o2
Pk	Papakating silt loam	176	IVw-4	26	4w2
Pm	Papakating mucky silt loam	176	IVw-5	27	4w1
PpA	Phelps gravelly loam, 0 to 3 percent slopes	177	IIw-1	18	2o2
PpB	Phelps gravelly loam, 3 to 8 percent slopes	177	IIe-4	18	2o2
Rh	Red Hook gravelly loam	178	IIIw-1	22	3w4
Ro	Rock outcrop	178	-----	--	---
ScA	Scio silt loam, 0 to 3 percent slopes	179	IIw-1	18	2o1
ScB	Scio silt loam, 3 to 8 percent slopes	179	IIe-5	18	2o1
Su	Sun silt loam	179	IVw-2	26	4w2
Te	Teel silt loam	180	IIw-4	19	2o3
Tg	Tioga silt loam	181	I-2	17	2o3
TuA	Tuller channery silt loam, 0 to 3 percent slopes	181	IVw-1	26	5w1
TuB	Tuller channery silt loam, 3 to 8 percent slopes	182	IVw-1	26	5w1
VaB	Varysburg gravelly loam, 2 to 8 percent slopes	183	IIe-4	18	2o2
VaC	Varysburg gravelly loam, 8 to 15 percent slopes	183	IIIe-4	21	2o2
VaD	Varysburg gravelly loam, 15 to 25 percent slopes	184	IVe-5	25	2r3
VoA	Volusia channery silt loam, 0 to 3 percent slopes	184	IIIw-2	23	3w5
VoB	Volusia channery silt loam, 3 to 8 percent slopes	184	IIIw-6	24	3w5
VoC	Volusia channery silt loam, 8 to 15 percent slopes	185	IIIe-9	22	3w5
Wa	Wallington silt loam	185	IIIw-2	23	3w5
Wk	Wallkill silt loam	186	IVw-5	27	4w1
Wn	Wayland silt loam	187	IVw-4	26	4w2
WoB	Williamson silt loam, 3 to 8 percent slopes	188	IIe-5	18	2o1
WoC	Williamson silt loam, 8 to 15 percent slopes	188	IIIe-6	21	2r2
WsB	Williamson channery silt loam, 3 to 8 percent slopes	188	IIw-3	19	2o1
WsC	Williamson channery silt loam, 8 to 15 percent slopes	188	IIIe-2	20	2r2

GUIDE TO MAPPING UNITS

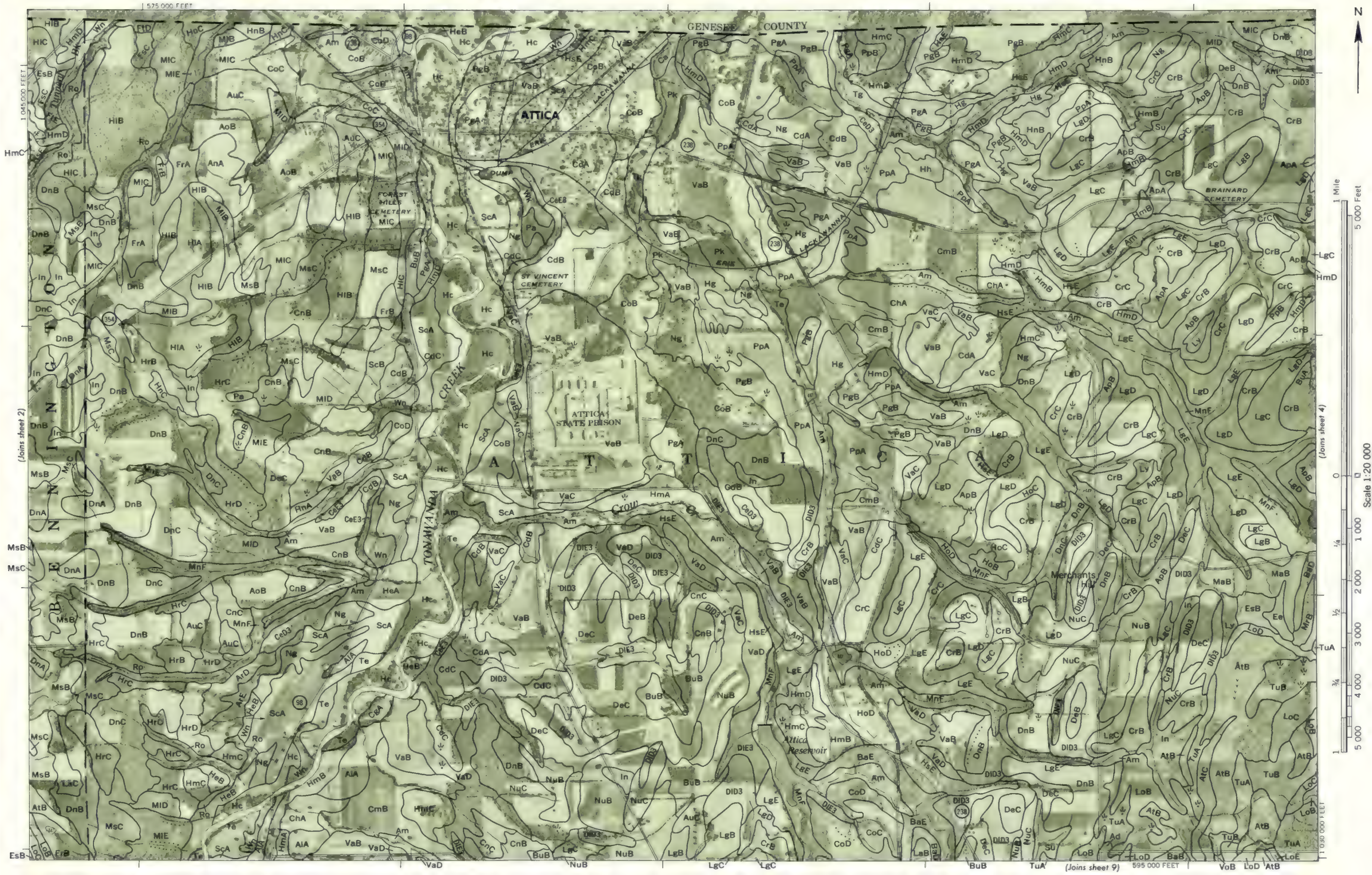
For a full description of a mapping unit, read both the description of the mapping unit and of the soil series to which the mapping unit belongs. Other information is given in tables as follows:

Estimated yields, table 1, page 30.
Woodland suitability groups, table 2, page 36.
Wildlife habitat elements and classes of wildlife, table 3, page 40.
Engineering uses of the soils, tables 4, 5, and 6, pages 46 through 95.
Limitations of the soils for town and country planning, table 7, page 102.
Acreage and extent, table 8, page 127.
Soil series classification according to the current system, table 9, page 192.

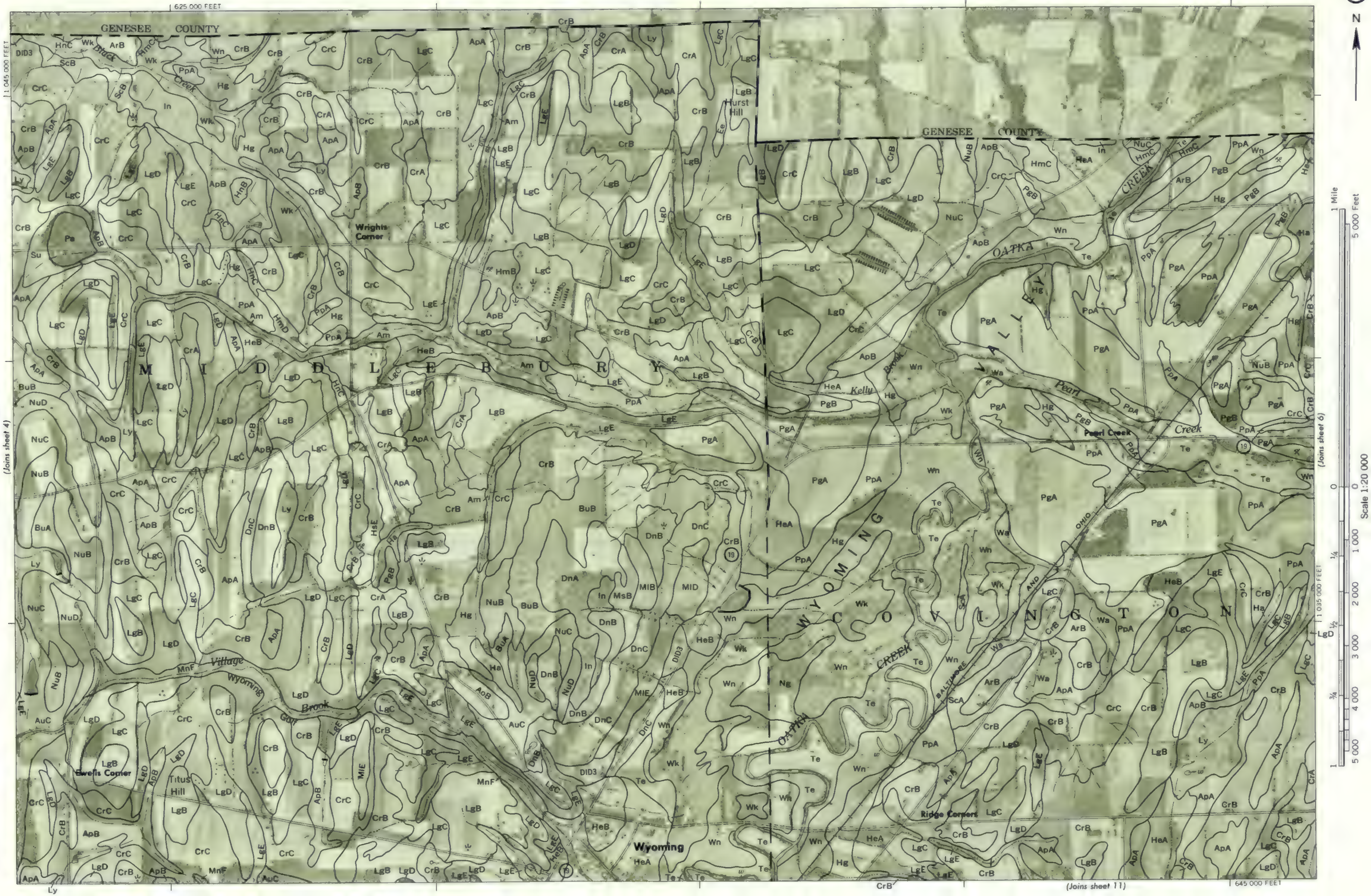
Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Number
Ad	Alden mucky silt loam	126	IVw-5	27	4w1
AlA	Allard silt loam, 0 to 3 percent slopes	129	I-1	16	2o1
AlB	Allard silt loam, 3 to 8 percent slopes	129	IIe-3	17	2o1
AlC	Allard silt loam, 8 to 15 percent slopes	129	IIIe-3	21	2r2
Am	Alluvial land	129	-----	--	---
AnA	Angola shaly silt loam, 0 to 3 percent slopes	130	IIIw-1	22	3w1
AoB	Angola and Aurora shaly silt loams, 3 to 8 percent slopes	130	IIIw-5	24	3w1
ApA	Appleton gravelly silt loam, 0 to 3 percent slopes	131	IIIw-1	22	3w1
ApB	Appleton gravelly silt loam, 3 to 8 percent slopes	131	IIIw-5	24	3w1
ArB	Arkport very fine sandy loam, 2 to 8 percent slopes	132	IIe-3	17	2o1
ArC	Arkport very fine sandy loam, 8 to 15 percent slopes	132	IIIe-3	21	2o1
ArD	Arkport very fine sandy loam, 15 to 25 percent slopes	132	IVe-3	25	2r1
ArE	Arkport very fine sandy loam, 25 to 40 percent slopes	132	VIe-4	27	2r1
AtB	Arnot channery silt loam, 2 to 8 percent slopes	133	IIIe-7	22	4d1
AtC	Arnot channery silt loam, 8 to 15 percent slopes	133	IVe-2	25	4d1
AuC	Aurora shaly silt loam, 8 to 15 percent slopes	134	IIIe-4	21	2o2
BaA	Bath channery silt loam, 0 to 3 percent slopes	135	I-1	16	3o1
BaB	Bath channery silt loam, 3 to 8 percent slopes	135	IIe-2	17	3o1
BaC	Bath channery silt loam, 8 to 15 percent slopes	135	IIIe-2	20	3o1
BaD	Bath channery silt loam, 15 to 25 percent slopes	135	IVe-1	24	3r1
BaE	Bath channery silt loam, 25 to 40 percent slopes	135	VIe-1	27	3r1
BlA	Bath-Valois gravelly loams, 0 to 3 percent slopes	136	I-1	16	3o1
BlB	Bath-Valois gravelly loams, 3 to 8 percent slopes	136	IIe-2	17	3o1
BlC	Bath-Valois gravelly loams, 8 to 15 percent slopes	136	IIIe-2	20	3o1
BlD	Bath-Valois gravelly loams, 15 to 25 percent slopes	136	IVe-1	24	3r1
BuA	Burdett silt loam, 0 to 3 percent slopes	137	IIIw-1	22	3w1
BuB	Burdett silt loam, 3 to 8 percent slopes	137	IIIw-5	24	3w1
Ca	Canadice silty clay loam	138	IVw-3	26	4w2
CcA	Canaseraga silt loam, 0 to 3 percent slopes	139	IIw-2	18	2o1
CcB	Canaseraga silt loam, 3 to 8 percent slopes	139	IIe-5	18	2o1
CcC	Canaseraga silt loam, 8 to 15 percent slopes	139	IIIe-6	21	2r2
CdA	Caneadea silt loam, 0 to 3 percent slopes	140	IIIw-3	23	3w2
CdB	Caneadea silt loam, 3 to 8 percent slopes	140	IIIw-4	23	3w2
CdC	Caneadea silt loam, 8 to 15 percent slopes	140	IIIe-8	22	3w3
CeD3	Caneadea silty clay loam, 15 to 25 percent slopes, eroded	140	VIe-3	27	3r2
CeE3	Caneadea silty clay loam, 25 to 50 percent slopes, eroded	141	VIIe-1	28	3r2
CgA	Castile gravelly loam, 0 to 3 percent slopes	141	IIw-1	18	3o1
CgB	Castile gravelly loam, 3 to 8 percent slopes	142	IIe-4	18	3o1
ChA	Castile channery silt loam, fans, 0 to 3 percent slopes	142	IIw-1	18	3o1
ClA	Chenango gravelly loam, 0 to 3 percent slopes	143	IIs-1	19	3o1
ClB	Chenango gravelly loam, 3 to 8 percent slopes	143	IIs-2	20	3o1
ClC	Chenango gravelly loam, 8 to 15 percent slopes	143	IIIe-1	20	3o1
ClD	Chenango gravelly loam, 15 to 25 percent slopes	143	IVe-1	24	3r1
CmB	Chenango channery silt loam, fans, 3 to 8 percent slopes	143	IIs-2	20	3o1
CnB	Churchville silt loam, 2 to 8 percent slopes	144	IIIw-4	23	3w2
CnC	Churchville silt loam, 8 to 15 percent slopes	145	IIIe-8	22	3w3
CoB	Collamer silt loam, 3 to 8 percent slopes	145	IIe-5	18	2o1
CoC	Collamer silt loam, 8 to 15 percent slopes	146	IIIe-6	21	2r2
CoD	Collamer silt loam, 15 to 25 percent slopes	146	IVe-5	25	2r1
CrA	Conesus gravelly silt loam, 0 to 3 percent slopes	147	IIw-1	18	2o2
CrB	Conesus gravelly silt loam, 3 to 8 percent slopes	147	IIe-4	18	2o2
CrC	Conesus gravelly silt loam, 8 to 15 percent slopes	147	IIIe-4	21	2o2
DaA	Dalton silt loam, 0 to 3 percent slopes	148	IIIw-2	23	3w5
DaB	Dalton silt loam, 3 to 8 percent slopes	148	IIIw-6	24	3w5
DeB	Danley silt loam, 3 to 8 percent slopes	149	IIe-5	18	2o2
DeC	Danley silt loam, 8 to 15 percent slopes	149	IIIe-6	21	2o2
DlD3	Danley silty clay loam, 15 to 25 percent slopes, eroded	149	VIe-3	27	3r2
DlE3	Danley silty clay loam, 25 to 40 percent slopes, eroded	149	VIIe-1	28	3r2
DnA	Darien silt loam, 0 to 3 percent slopes	150	IIIw-1	22	3w1
DnB	Darien silt loam, 3 to 8 percent slopes	150	IIIw-5	24	3w1
DnC	Darien silt loam, 8 to 15 percent slopes	150	IIIe-9	22	3w1
Ee	Ellery silt loam	151	IVw-2	26	4w2
ErA	Erie silt loam, 0 to 3 percent slopes	152	IIIw-2	23	3w5
EsB	Erie channery silt loam, 3 to 8 percent slopes	152	IIIw-6	24	3w5
EsC	Erie channery silt loam, 8 to 15 percent slopes	152	IIIe-9	22	3w5
FrA	Fremont silt loam, 0 to 3 percent slopes	153	IIIw-1	22	3w2
FrB	Fremont silt loam, 3 to 8 percent slopes	153	IIIw-5	24	3w2
FsC	Fremont channery silt loam, 8 to 15 percent slopes	153	IIIe-9	22	3w3
FtD	Fremont and Hornell soils, 15 to 25 percent slopes	154	VIe-3	27	3r2
FtE	Fremont and Hornell soils, 25 to 40 percent slopes	154	VIIe-1	28	3r2
Ha	Halsey loam	155	IVw-2	26	4w2
Hc	Hamlin silt loam	155	I-2	17	2o3
HeA	Herkimer shaly silt loam, 0 to 3 percent slopes	156	I-1	16	2o2
HeB	Herkimer shaly silt loam, 3 to 8 percent slopes	156	IIe-1	17	2o2
Hg	Homer gravelly loam	157	IIIw-1	22	3w4
Hh	Homer gravelly loam, clayey substratum	157	IIIw-1	22	3w4
HlA	Hornell silt loam, 0 to 3 percent slopes	158	IIIw-3	23	3w2
HlB	Hornell silt loam, 3 to 8 percent slopes	158	IIIw-4	23	3w2
HlC	Hornell silt loam, 8 to 15 percent slopes	158	IIIe-8	22	3w3
HmA	Howard gravelly loam, 0 to 3 percent slopes	159	IIs-1	19	2o2
HmB	Howard gravelly loam, 3 to 8 percent slopes	159	IIs-2	20	2o2
HmC	Howard gravelly loam, 8 to 15 percent slopes	159	IIIe-1	20	2o2
HmD	Howard gravelly loam, 15 to 25 percent slopes	160	IVe-1	24	2r3
HnA	Howard shaly silt loam, 0 to 3 percent slopes	160	IIs-1	19	2o2
HnB	Howard shaly silt loam, 3 to 8 percent slopes	160	IIs-2	20	2o2
HnC	Howard shaly silt loam, 8 to 15 percent slopes	160	IIIe-1	20	2o2
HoB	Howard-Madrid gravelly loams, 3 to 8 percent slopes	160	IIs-2	20	2o2
HoC	Howard-Madrid gravelly loams, 8 to 15 percent slopes	160	IIIe-1	20	2o2
HoD	Howard-Madrid gravelly loams, 15 to 25 percent slopes	161	IVe-1	24	2r3
HrB	Howard-Madrid shaly silt loams, 3 to 8 percent slopes	161	IIs-2	20	2o2
HrC	Howard-Madrid shaly silt loams, 8 to 15 percent slopes	161	IIIe-1	20	2o2
HrD	Howard-Madrid shaly silt loams, 15 to 25 percent slopes	161	IVe-1	24	2r3

WYOMING COUNTY, NEW YORK — SHEET NUMBER 1

WYOMING COUNTY, NEW YORK — SHEET NUMBER 2


N
575 000 FEET
1 045 000 FEET
GENESEE COUNTY
ATTICA
LACKAWANNA
ERIE
FOREST HILLS CEMETERY
ST VINCENT CEMETERY
ATTICA STATE PRISON
BRAINARD CEMETERY
TONAWANDA CREEK
Crow Cr.
Merchants Hill
Attica Reservoir
BENNINGTON
ATTICA
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
595 000 FEET
1 030 000 FEET
Scale 1:20 000
1 Mile
5 000 Feet

WYOMING COUNTY, NEW YORK — SHEET NUMBER 4

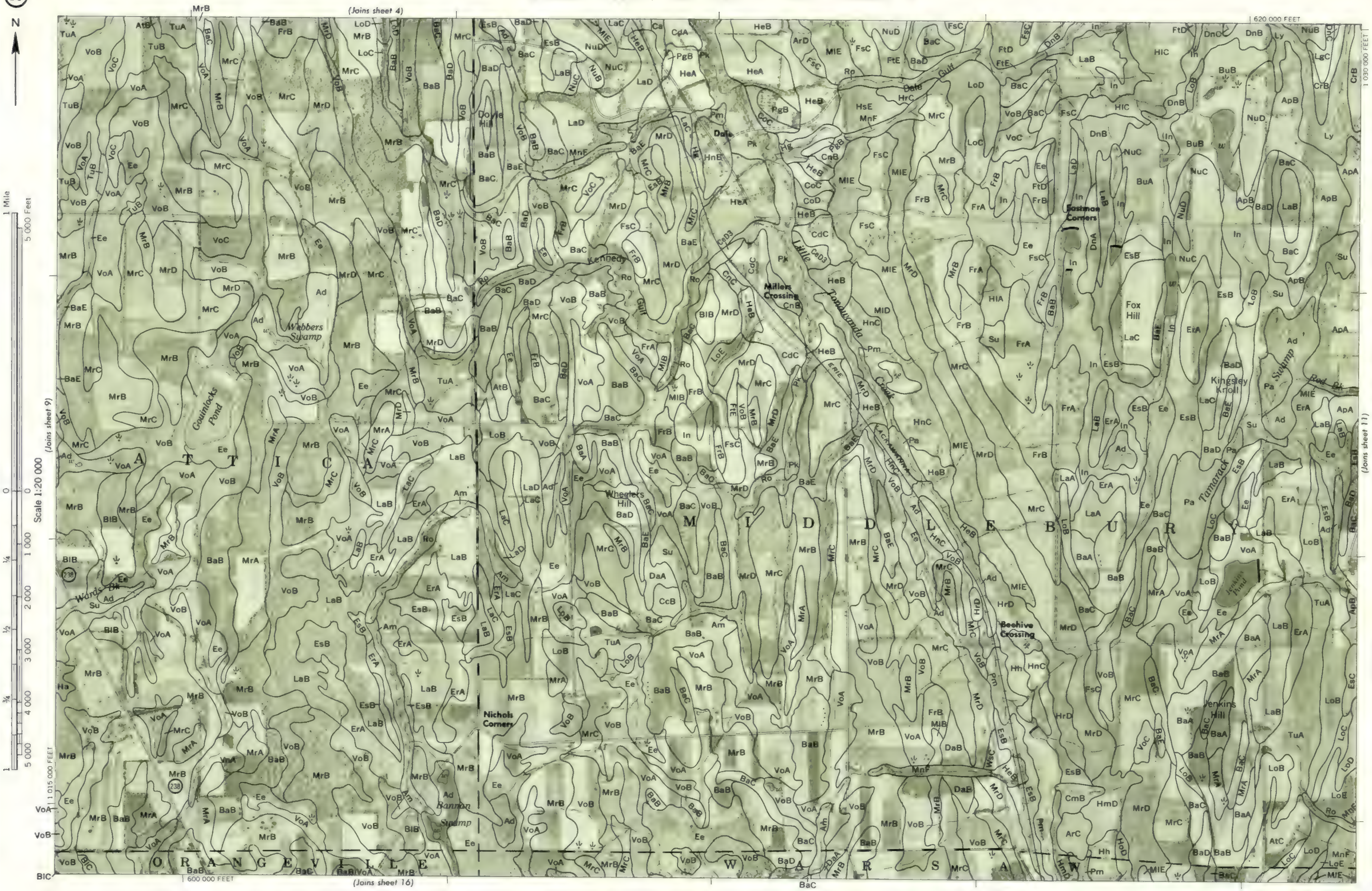

625 000 FEET
1 045 000 FEET
GENESEE COUNTY
GENESEE COUNTY
Black Creek
Hurst Hill
Wrights Corner
M I D D L E B U R Y
Kelly Brook
OATKA CREEK
VALLEY
Pearl Creek
Pearl Creek
OHIO
AND
BALTIMORE
WYOMING
WYOMING CREEK
C O V I N G T O N
Village
Wyoming
Gulf
Brook
Ewells Corner
Titus Hill
Ridge Corners
Wyoming
OATKA
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 11)
1 035 000 FEET
645 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20 000
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000

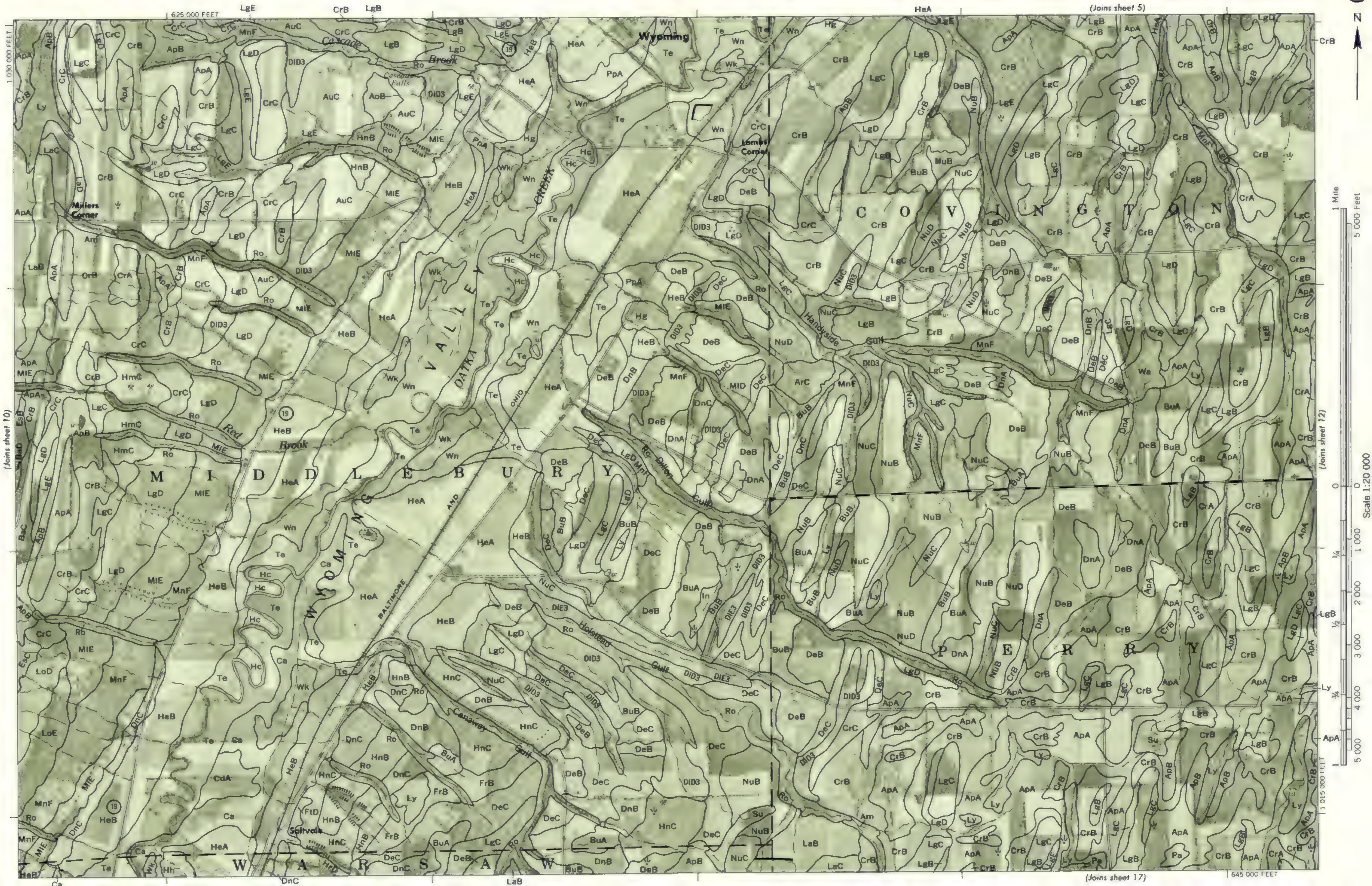

N
GENESEE COUNTY
LIVINGSTON COUNTY
C O V I N G T O N
Covington
Quinlan Corners
Boyds Corners
Bennetts Corners
OLIVET CEMETERY
Pikes Peak
Sprogues Corner
Paines Corner
Peoria
Pearl Creek
(Joins sheet 5)
(Joins sheet 12)
670 000 FEET
1 045 000 FEET
1 035 000 FEET
650 000 FEET
Scale 1:20 000
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000


7
N
525 000 FEET
(Joins sheet 1)
(Joins sheet 8)
(Joins sheet 13)
545 000 FEET
1 015 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000
B E N N I N G T O N
ERIE COUNTY
Little Buffalo Creek
CAYUGA CREEK
Right Branch Cayuga Cr.
CAMP SCHOELLKOPF

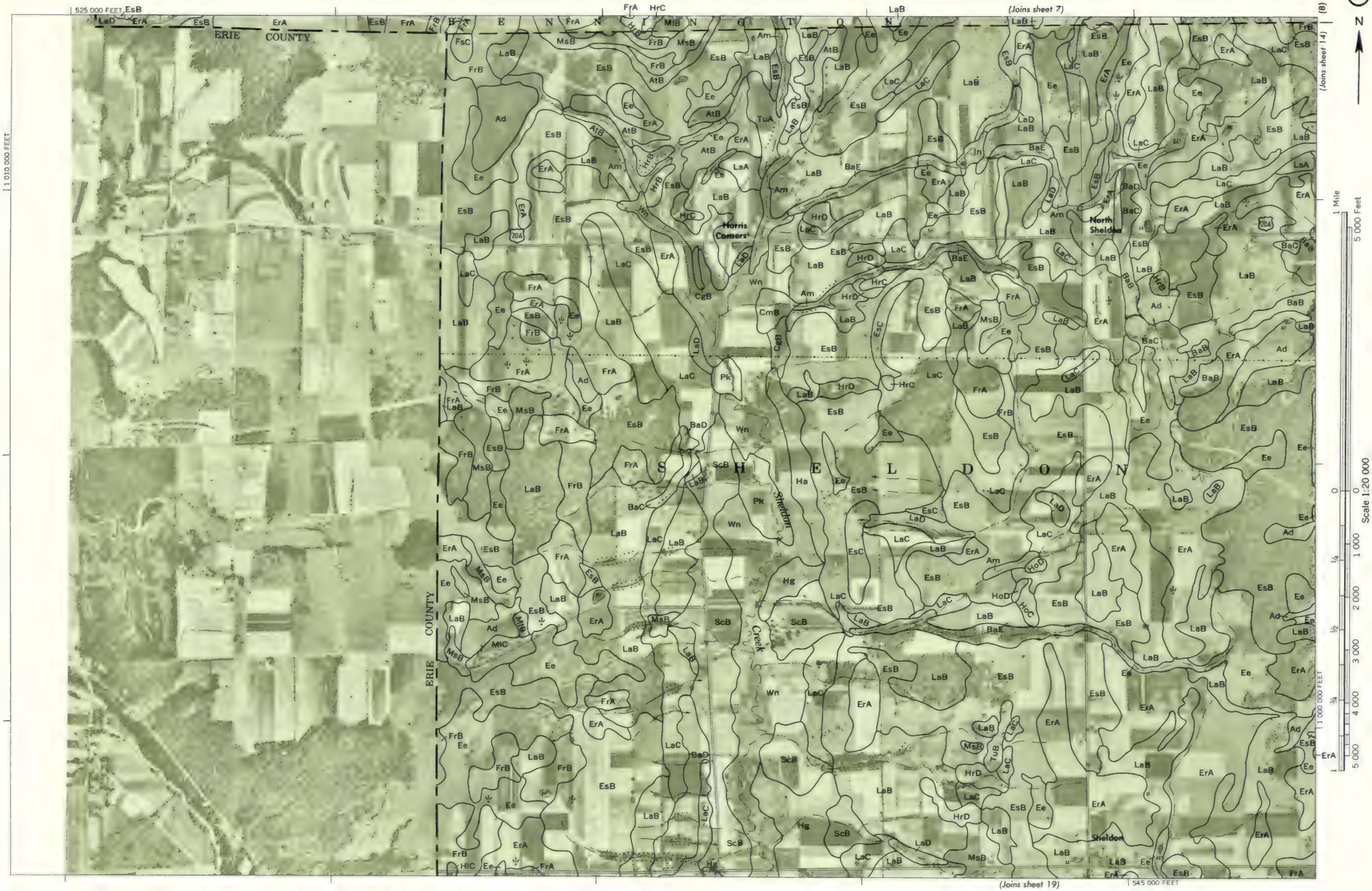

(Joins sheet 2)
(Joins sheet 9)
(Joins sheet 14)
(Joins sheet 7)
N
1 Mile
5 000 Feet
Scale 1:20 000
570 000 FEET
1 025 000 FEET
1 015 000 FEET
550 000 FEET
B E N N I N G T O N
Poland Hill
Orr Hill
Konawaugus
Creek
Gillett
Creek
Fenton
Creek
Johnson
Valley
Johnson Falls
Creek
CAYUGA
CREEK
TONAWANDA
CREEK
Earls

WYOMING COUNTY, NEW YORK — SHEET NUMBER 10

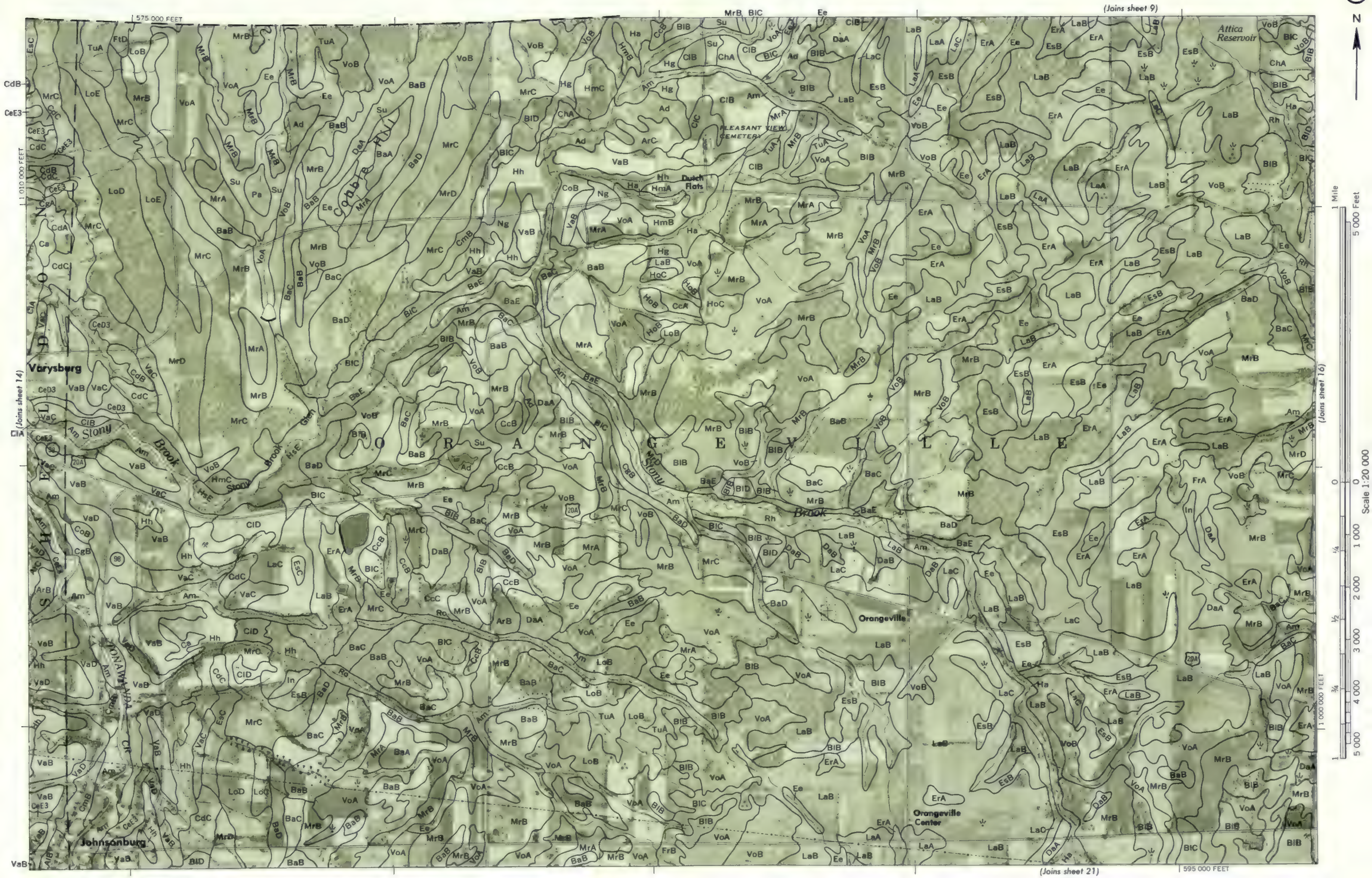



(Joins sheet 5)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 17)
625 000 FEET
645 000 FEET
1 030 000 FEET
1 015 000 FEET
N
Scale 1:20 000
1 Mile
5 000 Feet
Wyoming
Lamb's Corner
Millers Corner
Silver Springs
Cascade Brook
Cascade Falls
Red Brook
OATKA CREEK
WYOMING VALLEY
BALTIMORE AND OHIO
Handyside Gulf
Dillon Gulf
Halstead Gulf
Canaway Gulf
M I D D L E B U R Y
C O V I N G T O N
P E R R Y
W A R S A W


(Joins sheet 6)
(Joins sheet 11)
(Joins sheet 18)
C O V I N G T O N
P E R R Y
LIVINGSTON COUNTY
Lagrange
Lake Le Roy
Little Beards Creek
1 Mile
5 000 Feet
Scale 1:20 000
670 000 FEET
1 030 000 FEET
650 000 FEET
1 014 000 FEET

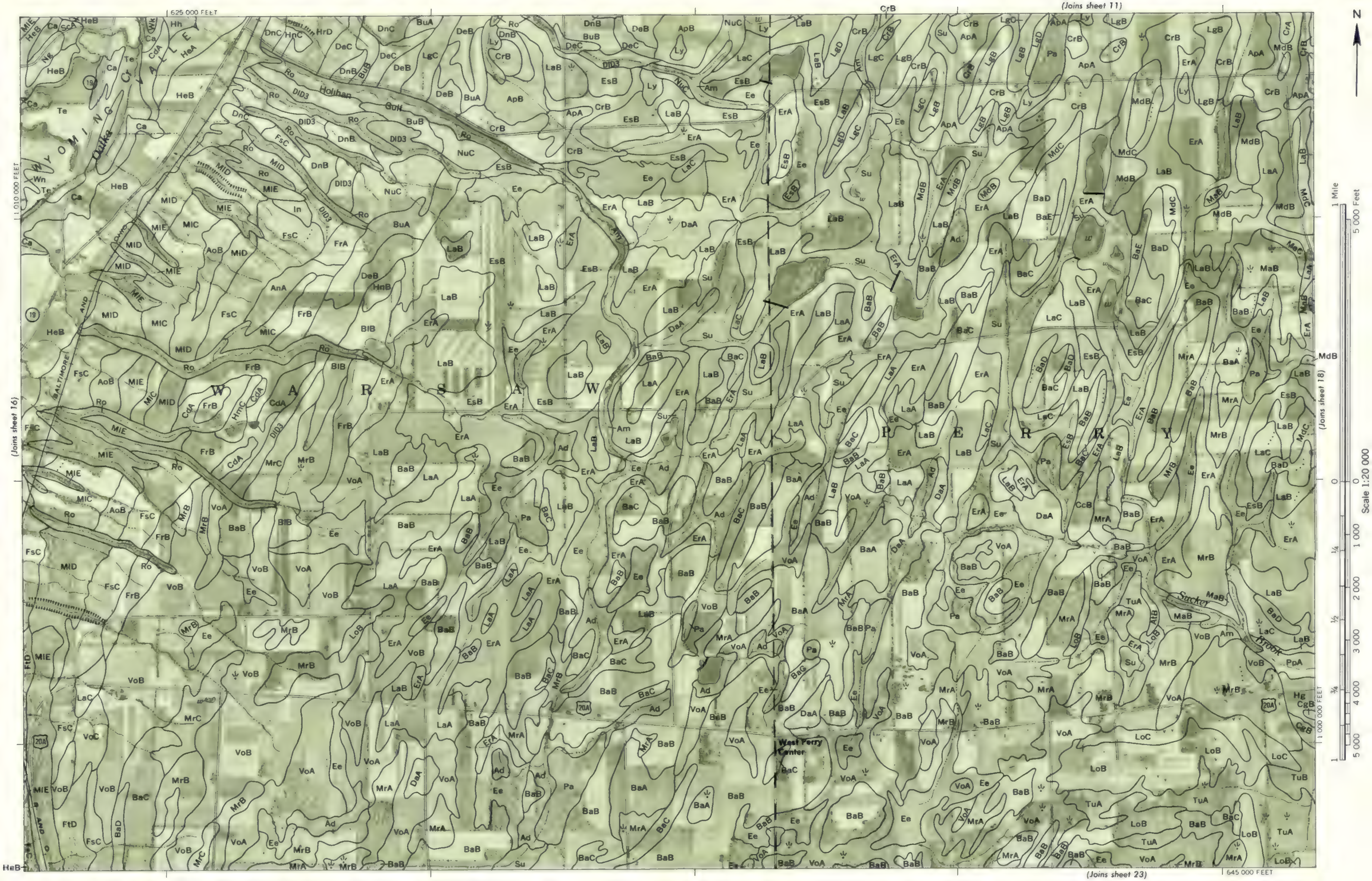

525 000 FEET
(Joins sheet 7)
(Joins sheet 14)
(Joins sheet 19)
545 000 FEET
1 010 000 FEET
1 000 000 FEET
ERIE COUNTY
BENNINGTON
SHELDON
North Sheldon
Harris Corners
Sheldon
Sheldon Creek
N
1 Mile
5 000 Feet
Scale 1:20 000

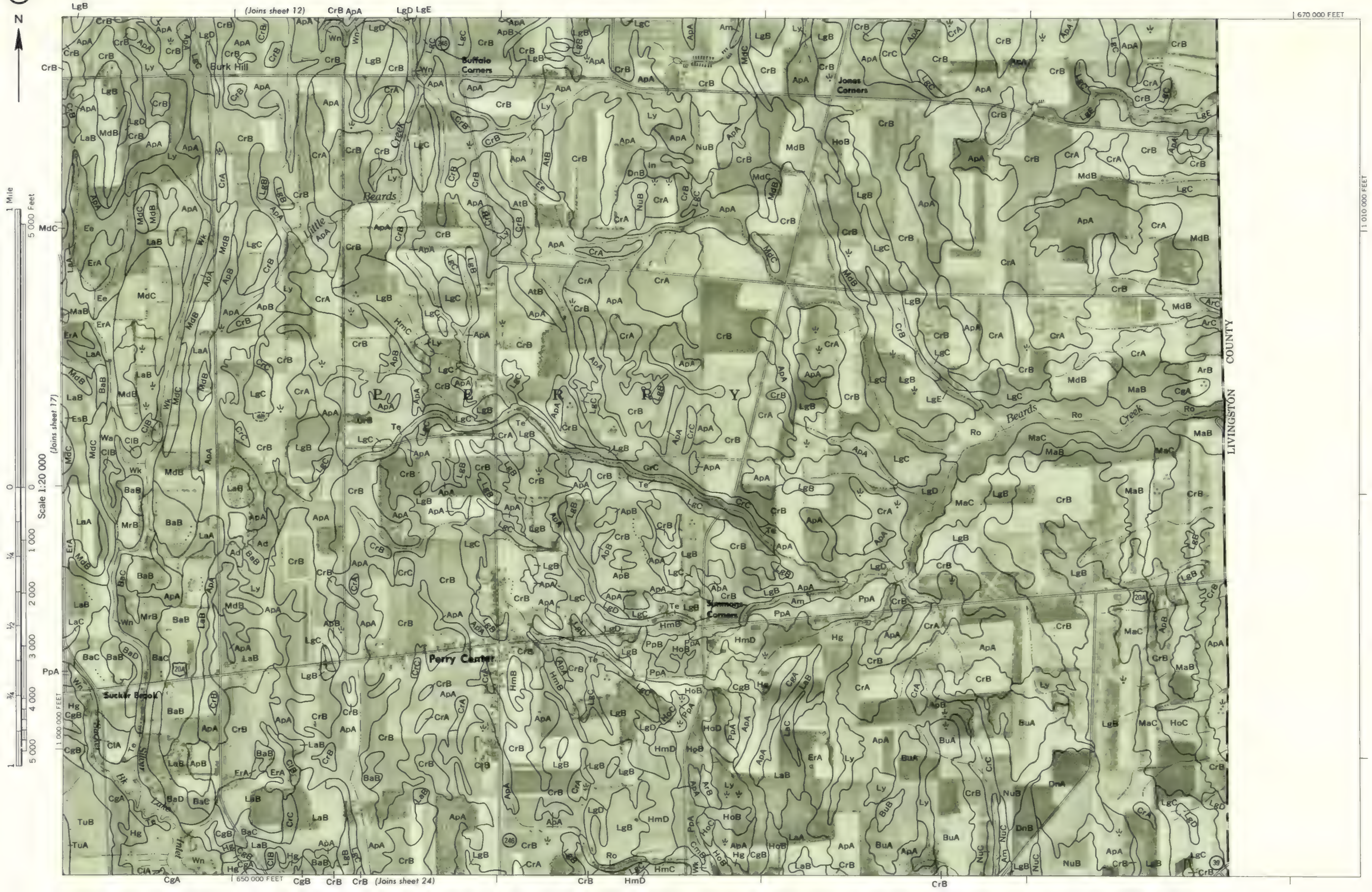

(Joins sheet 8)
(Joins sheet 20)
(Joins sheet 13)
(Join sheet 15)
N
Scale 1:20 000
1 Mile
5 000 Feet
570 000 FEET
550 000 FEET
1 010 000 FEET
1 000 000 FEET
Persons Corners
Varysburg
Sheldon Center
Toziers Corners
Cayuga Creek
TONAWANDA CREEK
S H E L D O N
HICKORY HILL



(Joins sheet 9)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 21)
575 000 FEET
595 000 FEET
1 010 000 FEET
1 000 000 FEET
N
Attica Reservoir
PLEASANT VIEW CEMETERY
Dutch Flats
Cobble Hill
Varysburg
Johnsonburg
Orangeville
Orangeville Center
O R A N G E V I L L E
SHELDON
Stony Brook
Glen Brook
Tonawanda Cr
1 Mile
5 000 Feet
Scale 1:20 000
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000

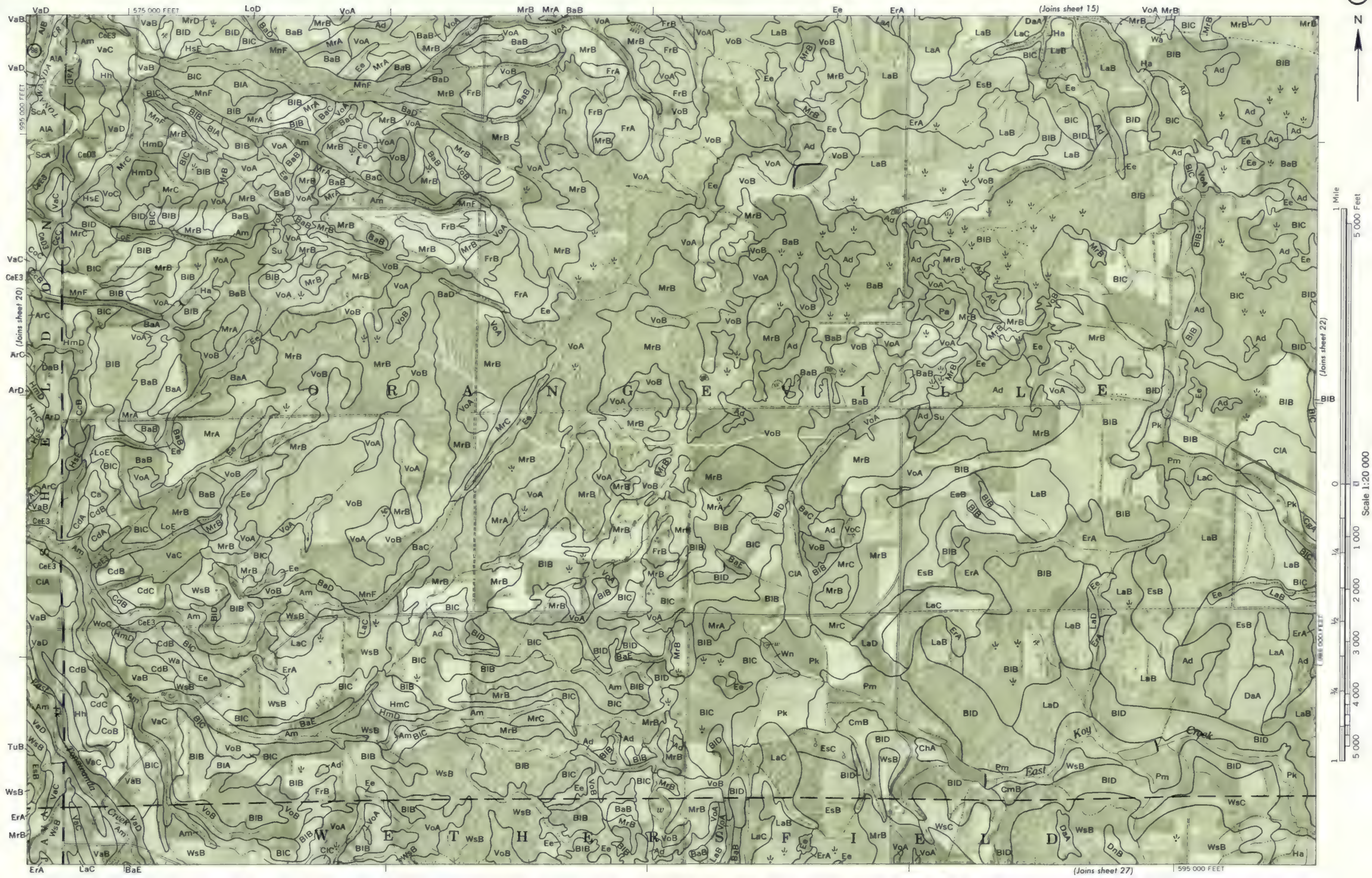
WYOMING COUNTY, NEW YORK — SHEET NUMBER 16


(Joins sheet 11)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 23)
625 000 FEET
645 000 FEET
1 010 000 FEET
1 000 000 FEET
WYOMING VALLEY
Oatka
Hollihan Gulf
BALTIMORE AND
W A R S A W
P E R R Y
Sucker Brook
West Perry Center
N
1 Mile
5 000 Feet
Scale 1:20 000

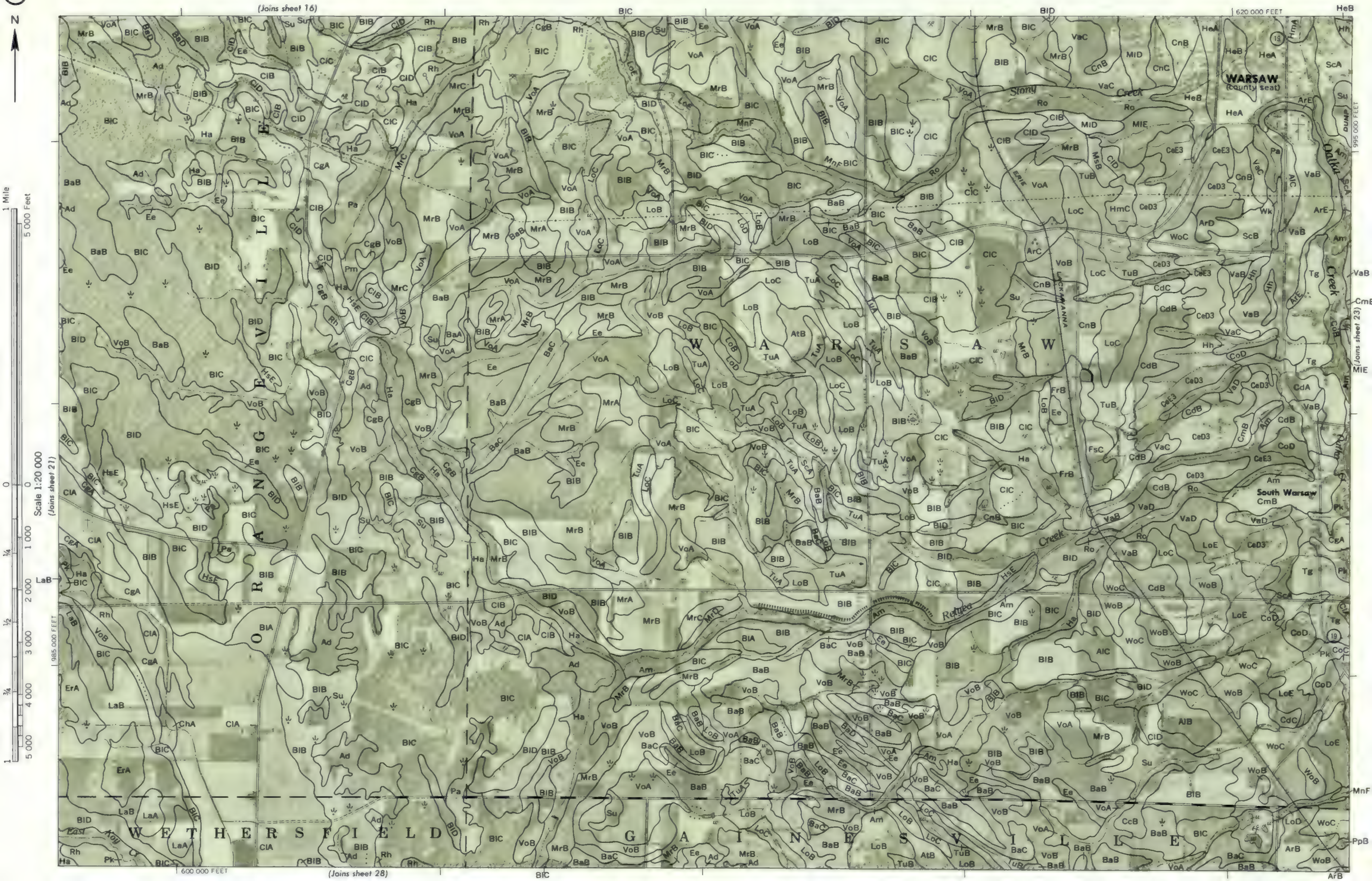

N
(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 24)
670 000 FEET
1 010 000 FEET
1 000 000 FEET
650 000 FEET
Scale 1:20 000
1 Mile
5 000 Feet
LIVINGSTON COUNTY
Buffalo Corners
Jones Corners
Burk Hill
Beards
Little
Creek
Beards Creek
P E R R Y
Perry Center
Sucker Brook
Silver Lake Inlet
Simmons Corners

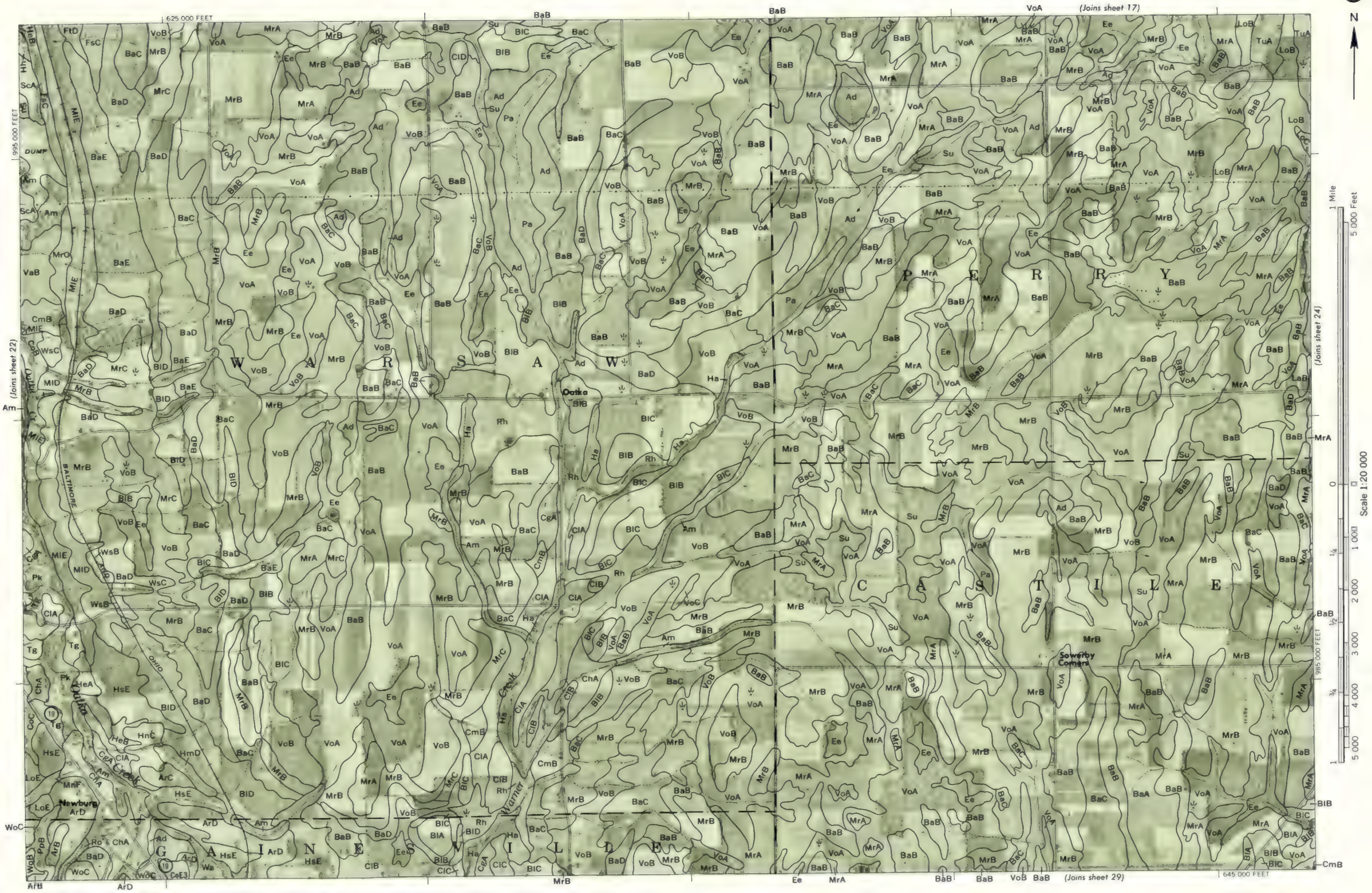

(Joins sheet 13)
(Joins sheet 20)
(Joins sheet 25)
N
525 000 FEET
995 000 FEET
985 000 FEET
545 000 FEET
ERIE COUNTY
S H E L D O N
J A V A
Sheldon Creek
Glade Creek
BUFFALO CREEK
Johnson Falls
ST CECILIAS CEMETERY
Strykersville
Plants Corners
78
1 Mile
5 000 Feet
Scale 1:20 000
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000


(Joins sheet 14)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 26)
570 000 FEET
995 000 FEET
985 000 FEET
550 000 FEET
Scale 1:20 000
1 Mile
5 000 Feet
N
SHELDON
JAVA
Frinks Corners
North Java Station
Cayuga Creek
Tonawanda Creek
East Fork Tonawanda Creek
TONAWANDA CREEK


(Joins sheet 15)
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 27)
575 000 FEET
995 000 FEET
595 000 FEET
O R A N G E V I L L E
W E T H E R S F I E L D
East Koy Creek
N
1 Mile
5 000 Feet
Scale 1:20 000

WYOMING COUNTY, NEW YORK — SHEET NUMBER 22




(Joins sheet 17)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 29)
625 000 FEET
995 000 FEET
985 000 FEET
645 000 FEET
W A R S A W
P E R R Y
C A S T I L E
G A I N E S V I L L E
Oatka
Sowerby Corners
Newburg
BALTIMORE
OHIO
Oatka Creek
Warner Creek
N
1 Mile
5 000 Feet
Scale 1:20 000


(Joins sheet 18)
(Joins sheet 23)
(Joins sheet 30)
670 000 FEET
995 000 FEET
985 000 FEET
650 000 FEET
N
Scale 1:20 000
1 Mile
5 000 Feet
PERRY
West Perry
Silver Lake
SILVER LAKE
Silver Lake Inlet
Silver Lake Outlet
P E R R Y
C A S T I L E
LIVINGSTON COUNTY
LETCHWORTH STATE PARK
BALTIMORE AND OHIO
DUMP

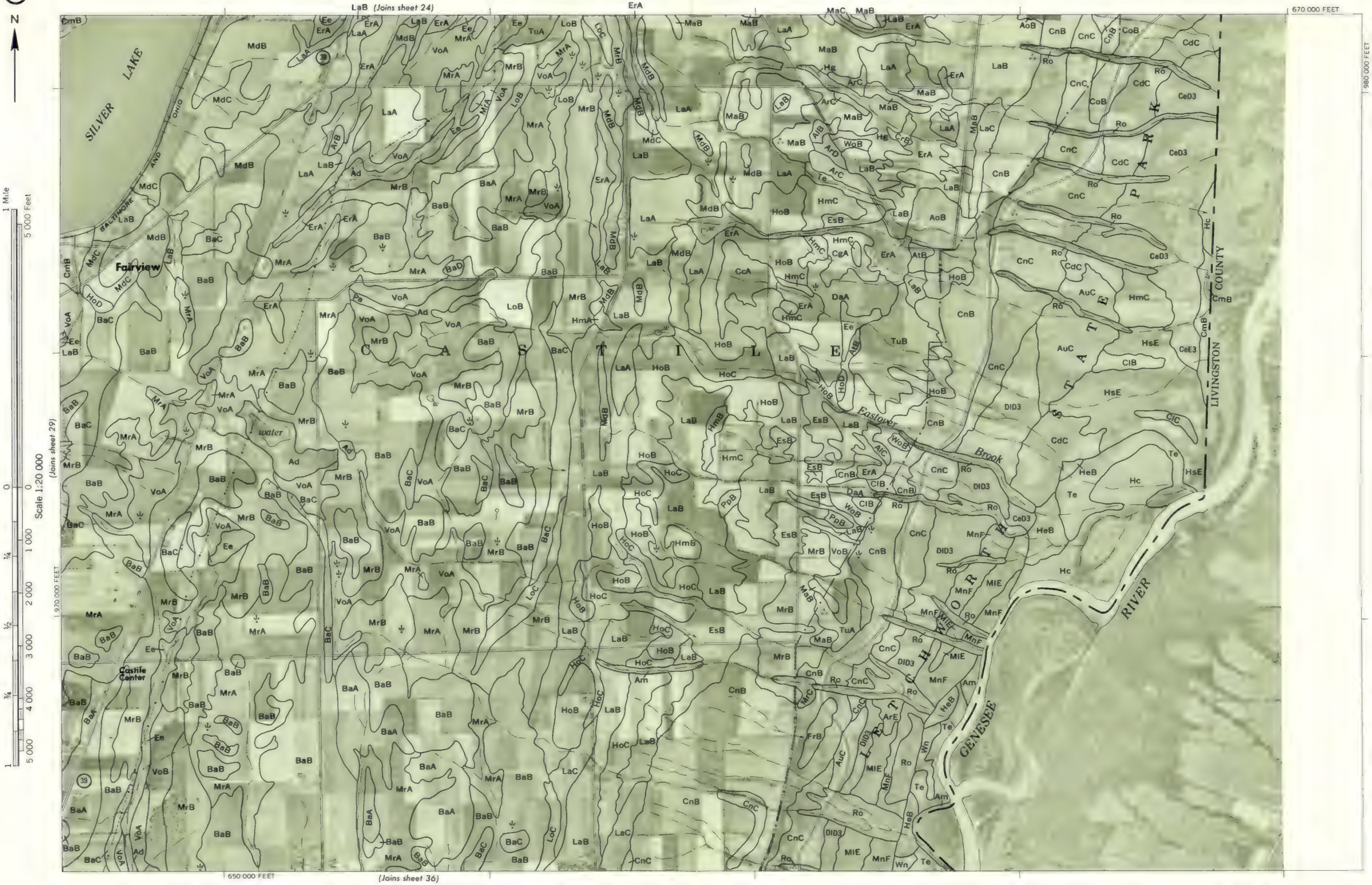
WYOMING COUNTY, NEW YORK — SHEET NUMBER 25

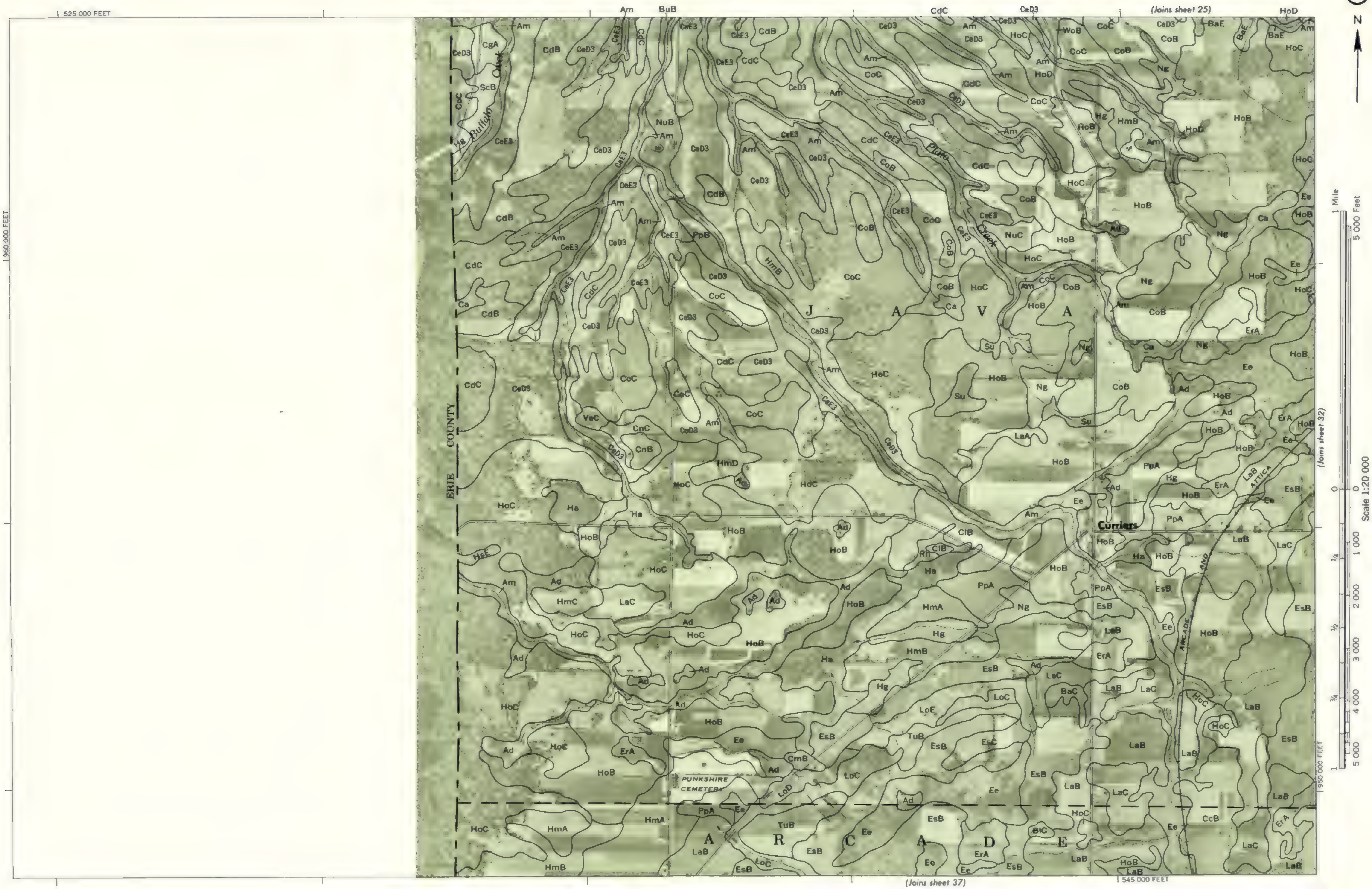

N
(Joins sheet 20)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 32)
570 000 FEET
980 000 FEET
550 000 FEET
965 000 FEET
Scale 1:20 000
1 Mile
5 000 Feet
Gallagher
Swamp
Tonawanda
Creek
North Java
SILVER MAPLE
CEMETERY
ST NICHOLAS
CEMETERY
Southburg
Beaver
Meadow
Beaver
Meadow
Creek
ARCADE AND ATTICA
J A V A
water
Java Center
Five Corners

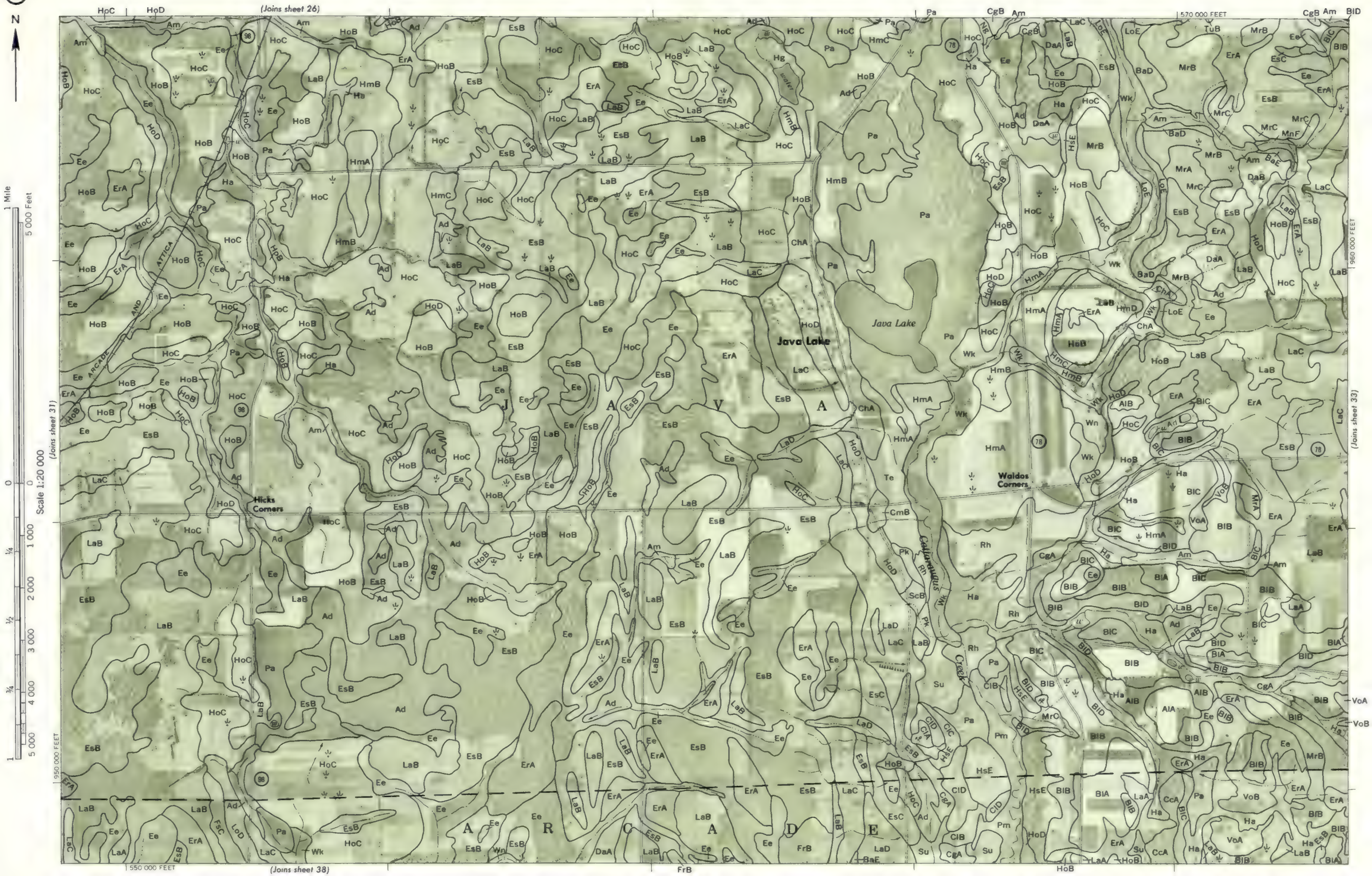

(Joins sheet 21)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 33)
575 000 FEET
595 000 FEET
980 000 FEET
965 000 FEET
W E T H E R S F I E L D
Union Corners
Poplar Tree Corners
Eastman Corners
Fawn Lake
N
1 Mile
5 000 Feet
Scale 1:20 000
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000


N
(Joins sheet 22)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 34)
620 000 FEET
980 000 FEET
600 000 FEET
965 000 FEET
Wethersfield Springs
North Gainesville
Hermitage
W E T H E R S F I E L D
G A I N E S V I L L E
East Koy Creek
Oatka Creek
1 Mile
5 000 Feet
Scale 1:20 000


(Joins sheet 23)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 35)
625 000 FEET
645 000 FEET
980 000 FEET
970 000 FEET
N
Rock Glen
Silver Lake Junction
Silver Springs
Fairview
Chaos
G A I N E S V I L L E
C A S T I L E
SILVER LAKE
Oatka Creek
Warner Creek
Wolf Creek
ERIE
LACKAWANNA
BALTIMORE AND OHIO
DUMP
Scale 1:20 000
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000

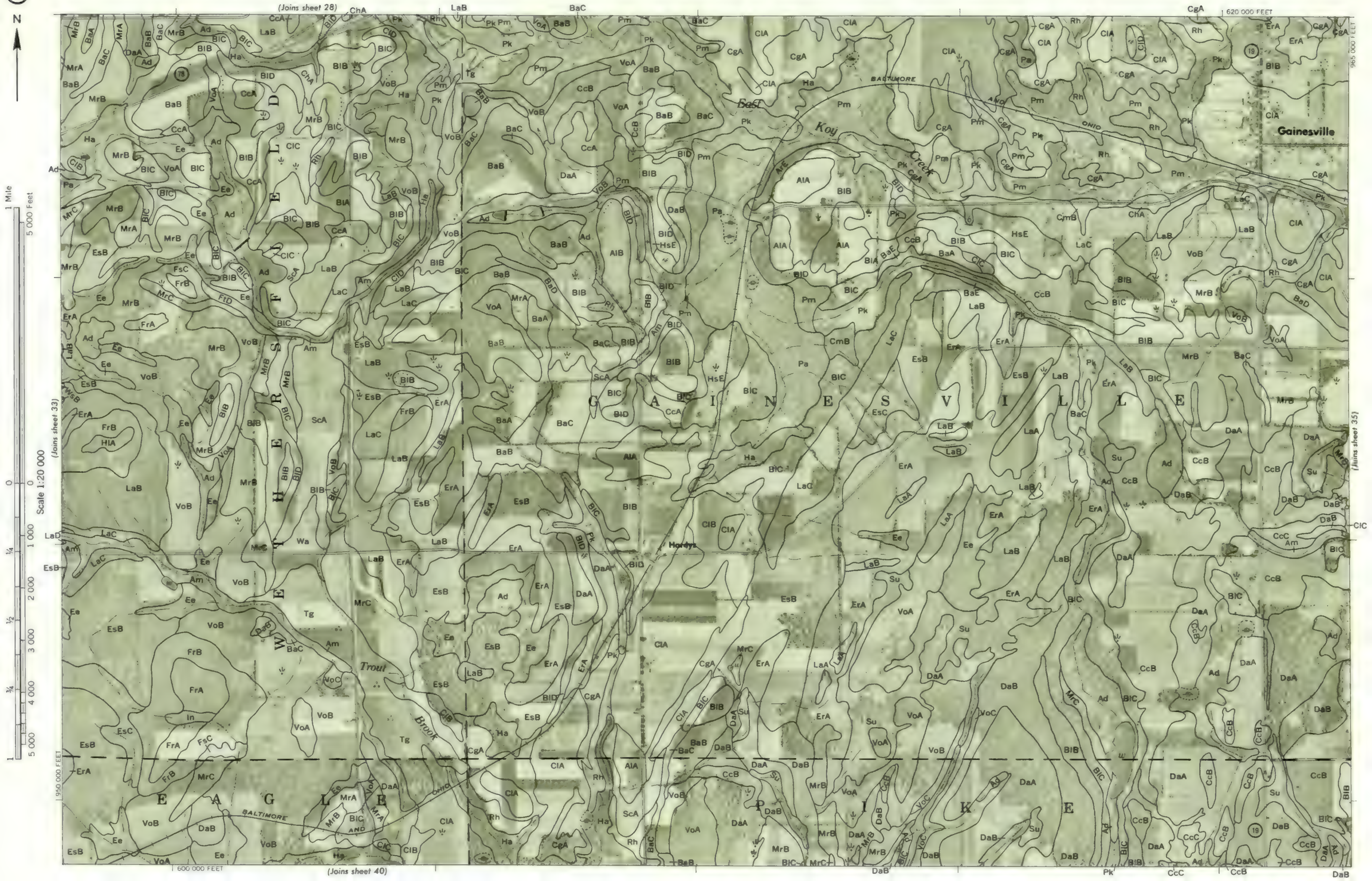

30
N
LaB (Joins sheet 24)
(Joins sheet 29)
(Joins sheet 36)
670 000 FEET
980 000 FEET
970 000 FEET
650 000 FEET
Scale 1:20 000
1 Mile
5 000 Feet
SILVER LAKE
BALTIMORE AND OHIO
Fairview
Castile Center
C A S T I L E
water
Eastover Brook
LETCHWORTH
STATE PARK
LIVINGSTON COUNTY
GENESEE RIVER


525 000 FEET
960 000 FEET
950 000 FEET
545 000 FEET
(Joins sheet 25)
(Joins sheet 32)
(Joins sheet 37)
N
ERIE COUNTY
JAVA
ARCADE
Curriers
Buffalo Creek
Plato Creek
PUNKSHIRE CEMETERY
ARCADE AND ATTICA
Scale 1:20 000
1 Mile
5 000 Feet


N
1 Mile
5 000 Feet
Scale 1:20 000
0
1 000
2 000
3 000
4 000
5 000
(Joins sheet 26)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 38)
570 000 FEET
960 000 FEET
950 000 FEET
550 000 FEET
ATTICA AND ARCADE
J A V A
A R C A D E
Java Lake
Hicks Corners
Waldos Corners
Cattaraugus Creek
water

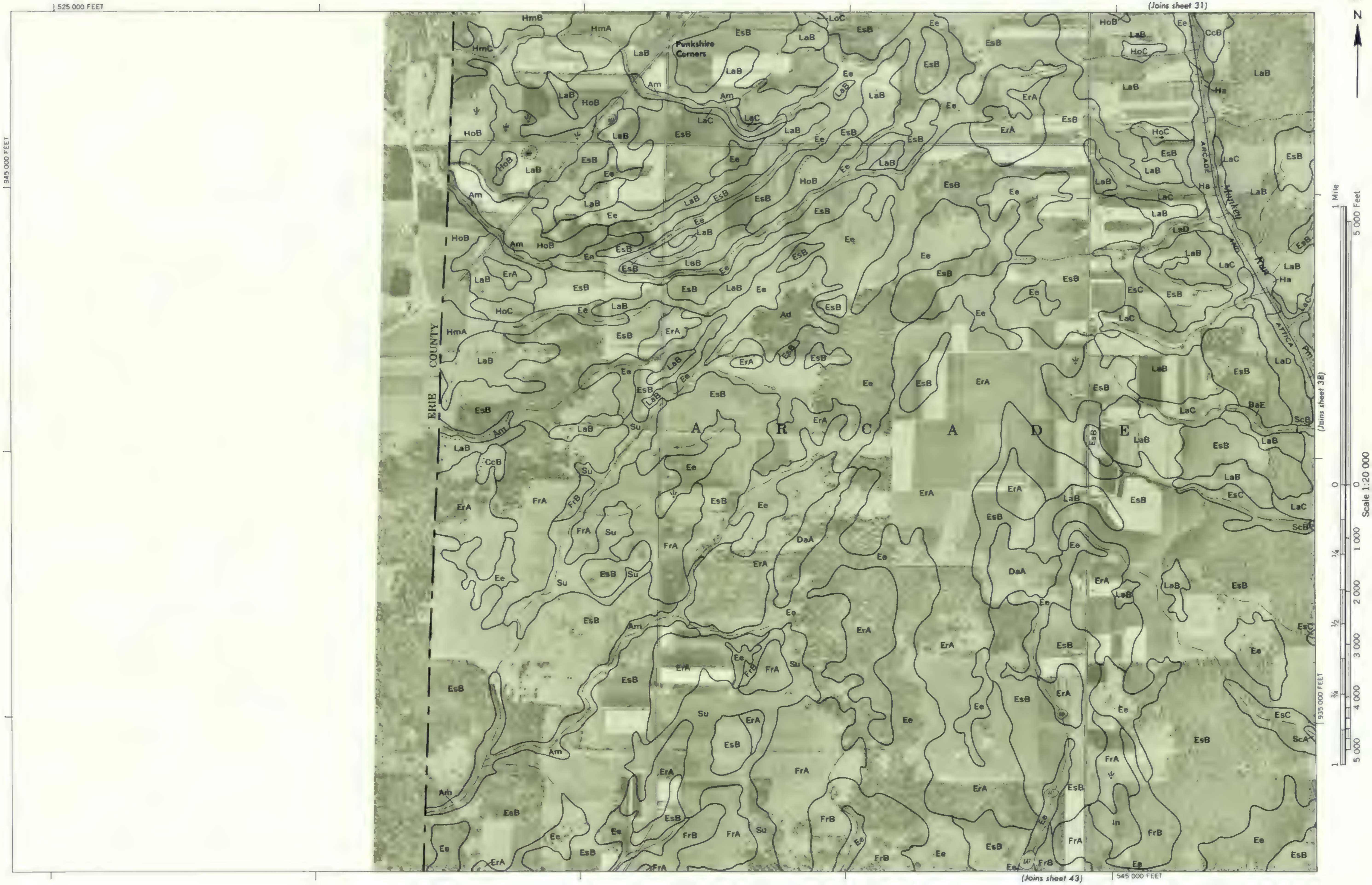

(Joins sheet 27)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 39)
575 000 FEET
950 000 FEET
595 000 FEET
Faun Lake
water
W E T H E R S F I E L D
Smiths Corners
North Branch
Wiscoy Creek
E A G L E
N
1 Mile
5 000 Feet
Scale 1:20 000

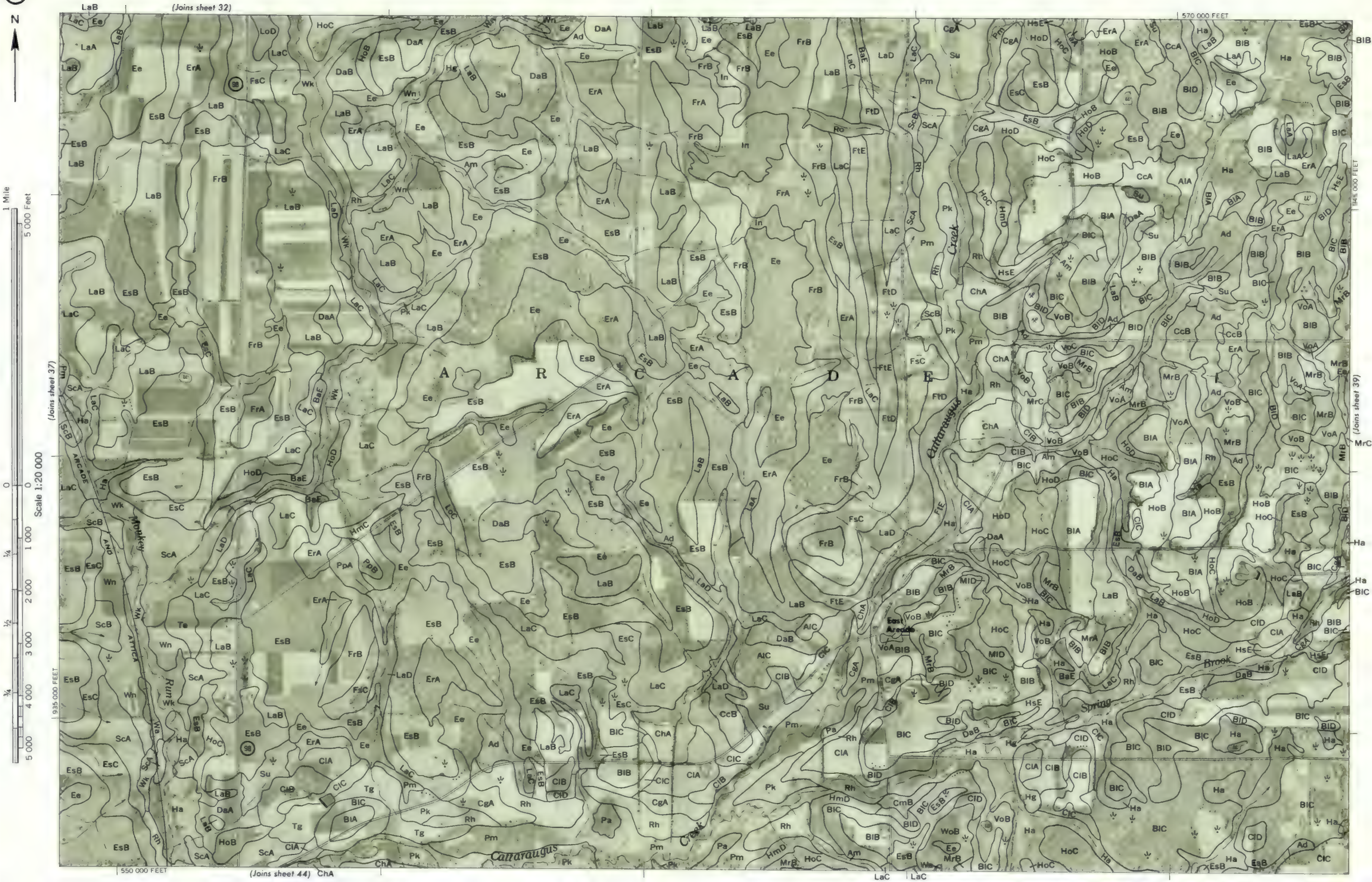
WYOMING COUNTY, NEW YORK — SHEET NUMBER 34




(Joins sheet 29)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 41)
625 000 FEET
645 000 FEET
965 000 FEET
950 000 FEET
N
G A I N E S V I L L E
C A S T I L E
CASTILE
P I K E
G E N E S E E F A L L S
BALTIMORE AND OHIO
ERIE LACKAWANNA
East Koy Creek
Wolf Creek
water
1 Mile
5 000 Feet
Scale 1:20 000

WYOMING COUNTY, NEW YORK — SHEET NUMBER 36

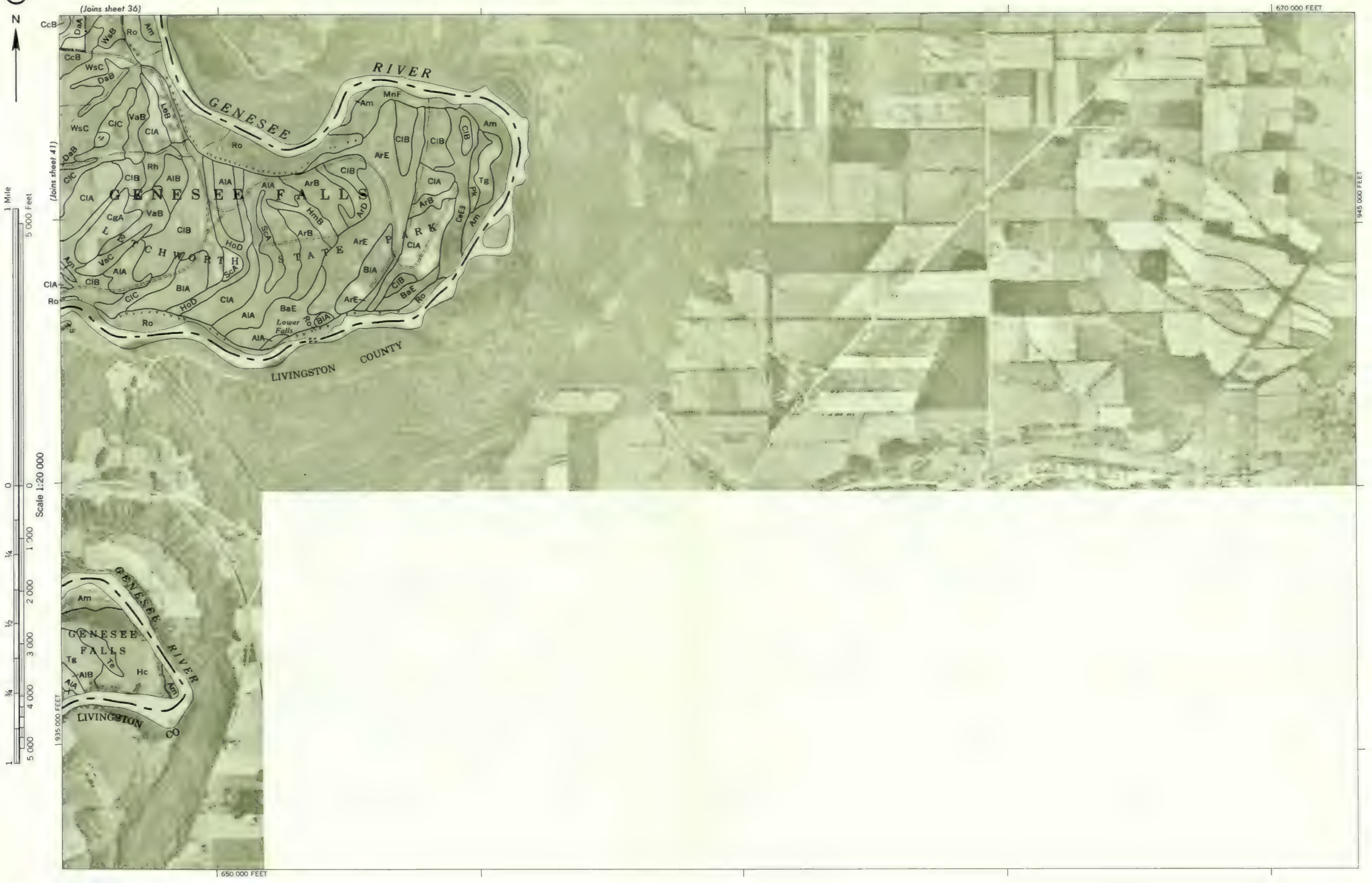

525 000 FEET
(Joins sheet 31)
945 000 FEET
Punkshire Corners
ERIE COUNTY
A R C A D E
ARCADE
Mankell Run
ATTICA
(Joins sheet 38)
935 000 FEET
(Joins sheet 43)
545 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20 000


N
(Joins sheet 32)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 44)
570 000 FEET
550 000 FEET
935 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000
A R C A D E
East Arcade
Cattaraugus Creek
Spring Brook
Monkey Run

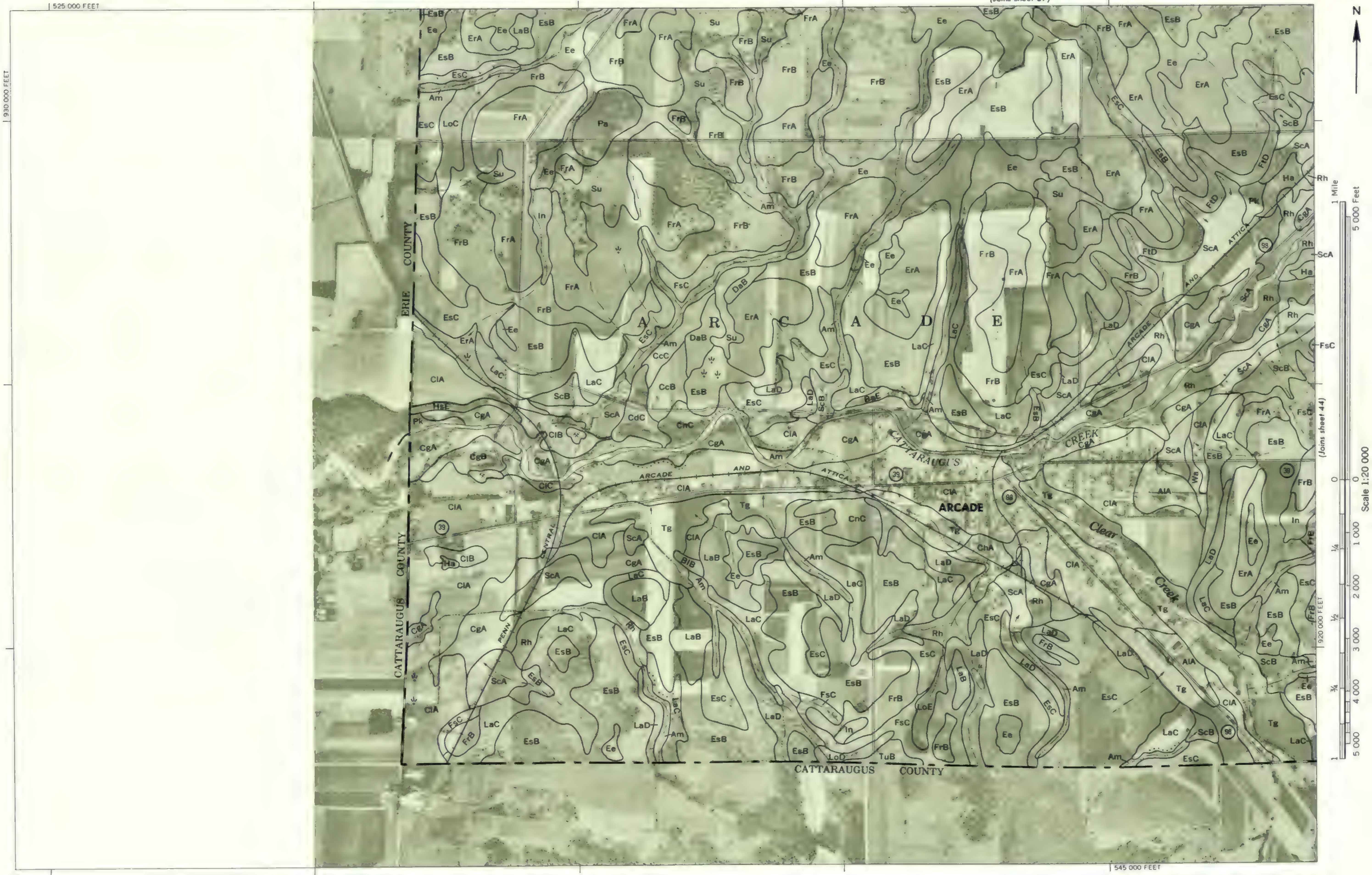

(Joins sheet 33)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 45)
575 000 FEET
595 000 FEET
945 000 FEET
935 000 FEET
N
Scale 1:20 000
1 Mile
5 000 Feet
Bliss
Howes
Wiscoy Creek
Spring Brook
North Branch
E A G L E

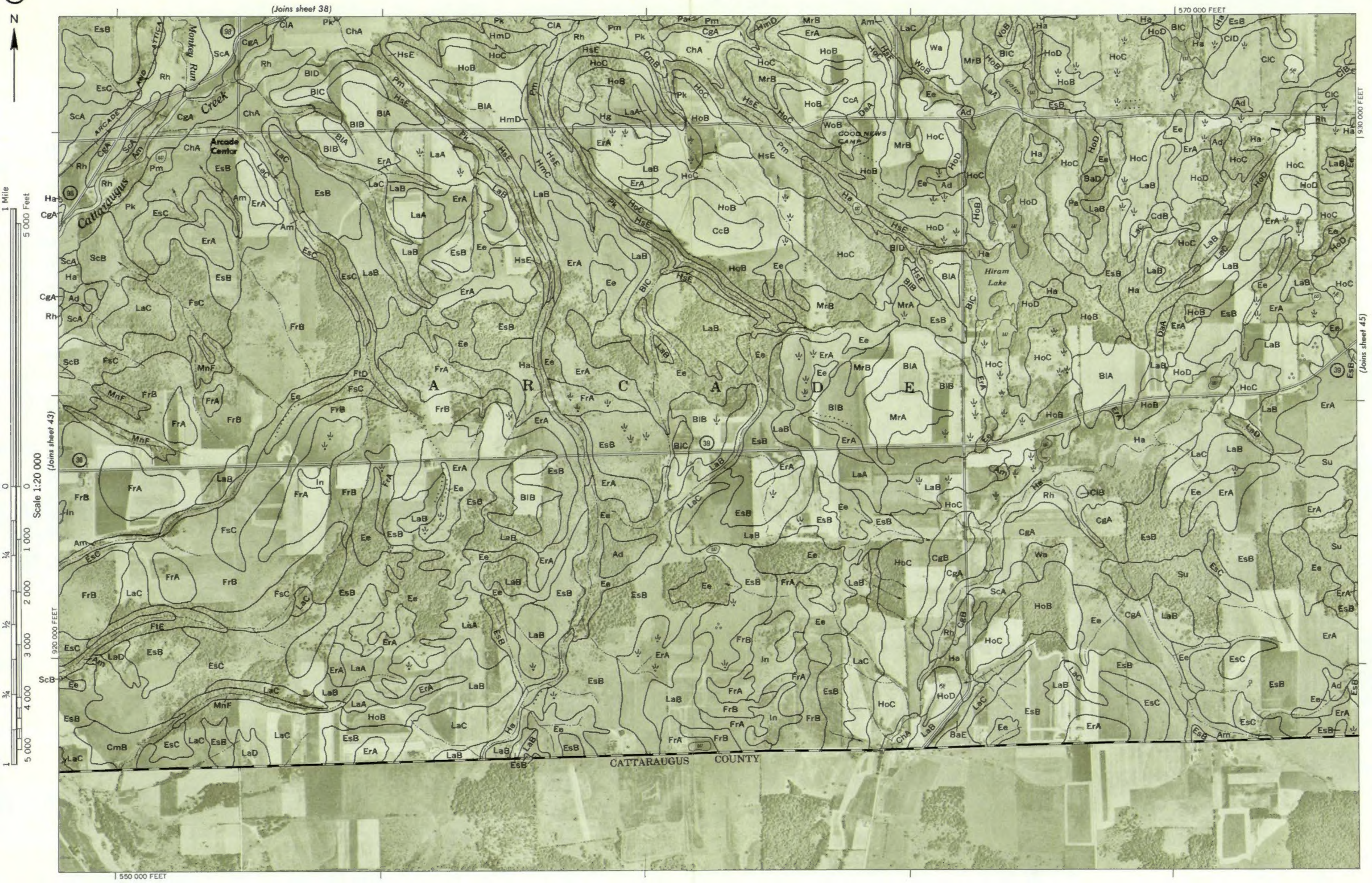
WYOMING COUNTY, NEW YORK — SHEET NUMBER 40

N
625 000 FEET
945 000 FEET
935 000 FEET
645 000 FEET
(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 47)
P I K E
G E N E S E E   F A L L S
Lamont
Bigelow Corners
Bishop Corners
Portageville
GRAVEL PIT
East Koy Creek
LACKAWANNA
ERIE
LETCHWORTH STATE PARK
LIVINGSTON COUNTY
GENESEE RIVER
Middle Falls
Upper Falls
water
1 Mile
5 000 Feet
Scale 1:20 000

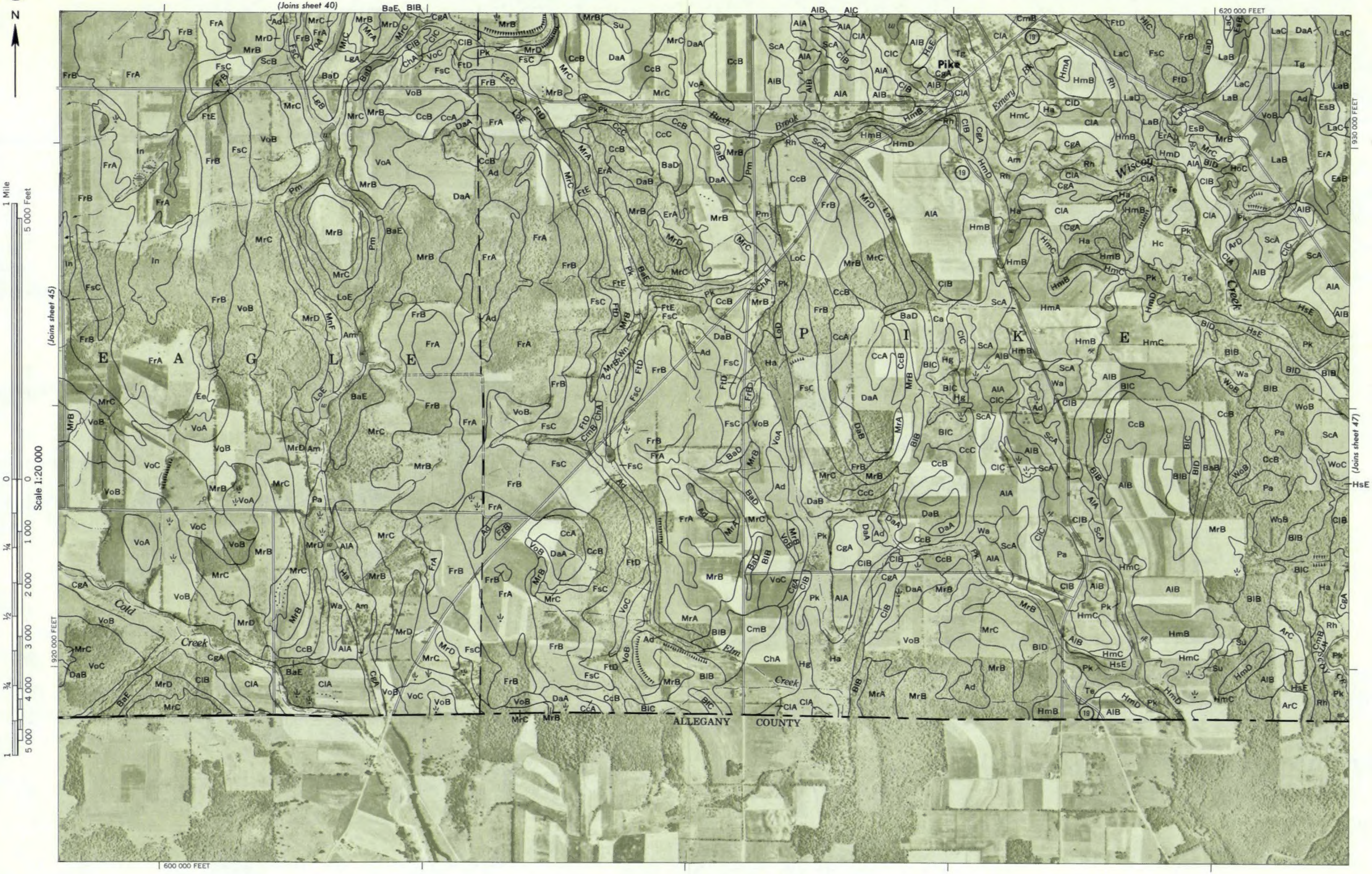

(Joins sheet 36)
(Joins sheet 41)
670 000 FEET
945 000 FEET
935 000 FEET
650 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20 000
GENESEE RIVER
GENESEE FALLS
LETCHWORTH STATE PARK
Lower Falls
LIVINGSTON COUNTY
LIVINGSTON CO
CcB
DaA
WsB
Ro
Am
WsC
DaB
ClC
VaB
LoB
ClA
MnF
ClB
ArE
Tg
Rh
AlB
AlA
ArB
CgA
HmB
ArD
Pk
CeE3
HoD
ScA
VaC
BlA
BaE
Te
Hc

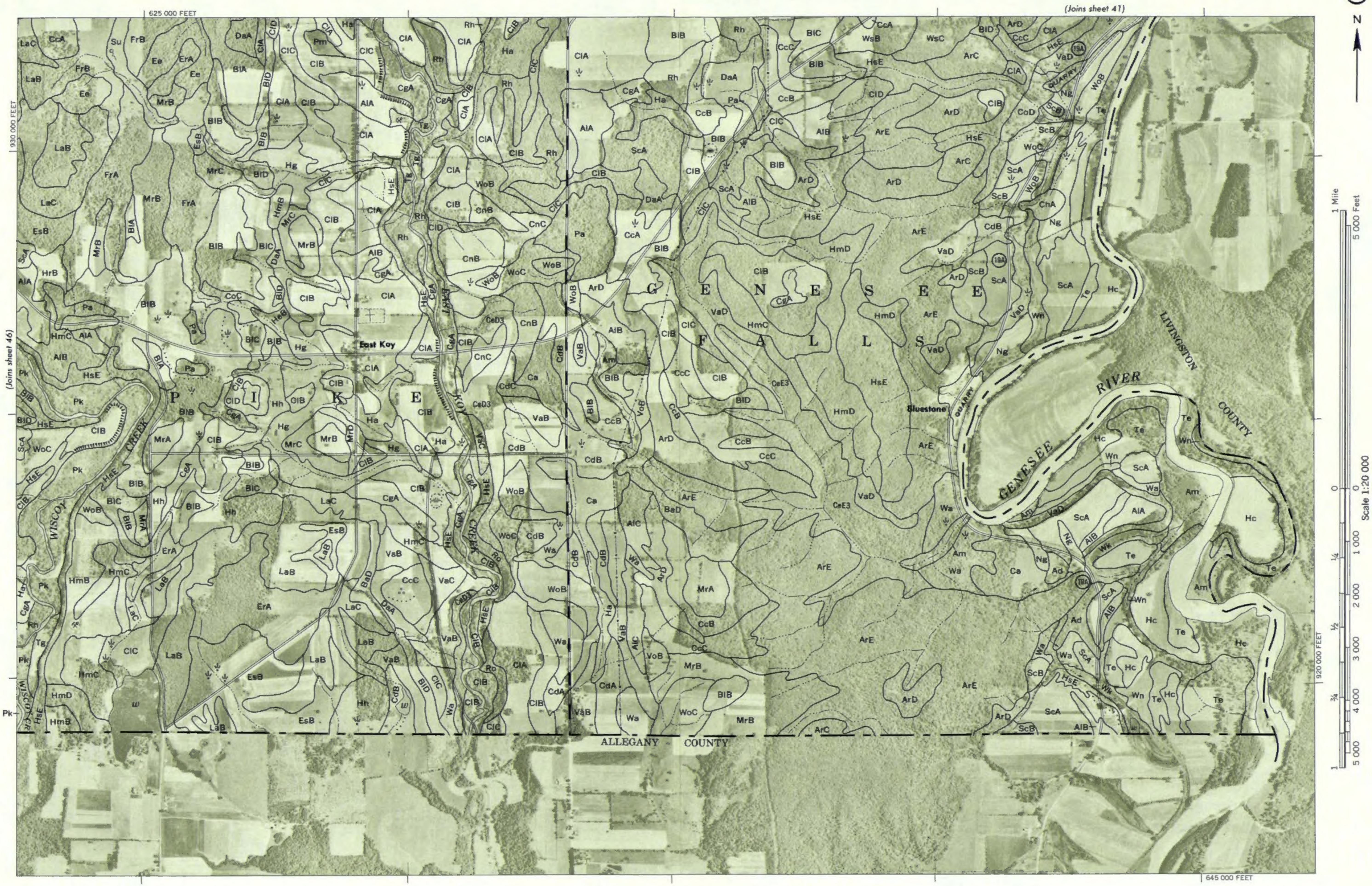
(Joins sheet 37)




N
(Joins sheet 38)
(Joins sheet 43)
(Joins sheet 45)
570 000 FEET
930 000 FEET
920 000 FEET
550 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000
A R C A D E
Cattaraugus Creek
Monkey Run
Arcade Center
Hiram Lake
GOOD NEWS CAMP
CATTARAUGUS COUNTY


575 000 FEET
(Joins sheet 39)
(Joins sheet 44)
(Joins sheet 46)
930 000 FEET
920 000 FEET
595 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20 000
E A G L E
Eagle
EAGLE CEMETERY
Eagle Center
Wing
Caldwells Corners
CAMP SHERWOOD FOREST
Wiscoy
BALTIMORE AND OHIO
Cold Cr
water
ALLEGANY COUNTY
ARCADE


N
(Joins sheet 40)
(Joins sheet 45)
(Joins sheet 47)
620 000 FEET
930 000 FEET
920 000 FEET
600 000 FEET
Pike
EAGLE
PIKE
ALLEGANY COUNTY
Bush Brook
Emery Bk
Wiscoy Creek
Cold Creek
Elm Creek
19
1 Mile
5 000 Feet
Scale 1:20 000
0
1 000
2 000
3 000
4 000
5 000
1/4
1/2
3/4
1


(Joins sheet 41)
(Joins sheet 46)
625 000 FEET
645 000 FEET
930 000 FEET
920 000 FEET
N
GENESEE FALLS
PIKE
East Koy
Bluestone
GENESEE RIVER
WISCOY CREEK
EAST KOY CREEK
LIVINGSTON COUNTY
ALLEGANY COUNTY
QUARRY
1 Mile
5 000 Feet
Scale 1:20 000